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AN ASSESSMENT OF THE INLAND WATER CROSSING PERFORMANCE OF SELEC--ETC(U)
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This study evaluates the relative water gap crossing performance and crossing assistance requirements of 16 current tactical support vehicles and four combat vehicles in two 1000-sq-km sample terrain areas, one in West Germany and one in the Mid-East, using analytical models.

The methodology uses a quantitative terrain data base describing the location and cross section and hydrologic characteristics of all rivers, streams and canals shown on 1:50,000 scale topographic map sheets for an area.

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20. Abstract (Continued).

Generation of the required gap data bases is described. The terrain data are interacted with approximately 20 vehicle engineering parameters to predict the unassisted gap-crossing performance of a vehicle at all described gaps during selected water stages. The same terrain data base is used to evaluate 16 different engineer procedures for providing crossing assistance where required. One of these options is selected on the basis of a preassigned priority list related in general terms to mission requirements. Finally, a mission-oriented search is made for favorable crossing locations. The method accepts one or more movement corridors and determines performance from one end of each corridor to the other along a best route using an optimizing function. For this study, route selection within a corridor is based entirely on gap-crossing assistance priorities.

The final vehicle-by-vehicle evaluations are in purely technical terms, without tactical influences beyond corridor definitions and the assigned crossing assistance priorities. Basic indices used are (a) the percent of all selected crossings which can be negotiated without assistance, (b) the mean distance along corridor axes between selected crossings for which some level of assistance is required, and (c) an index of the relative priority level of crossing assistance required per unit distance along the corridor.

These indices are presented in the report for each study tactical support vehicle as presently configured and as simply converted (on paper) to a deep-fording vehicle mechanically capable of fording still water depths equal to the height of the driver's seat cushion above ground, and for the four combat vehicles in their present configurations. For each configuration, figures are given for three water stages in the West Germany study area, two in the Mid-East study area; for combined axis distances of 430 km in the West Germany area, 350 km in the Mid-East area; each for movement corridor widths of 1, 2, and 4 km.

Two principal conclusions are drawn. First, in terrain similar to that of the West Germany study area effective tactical support in forward areas under intense combat conditions requires solution of the gap crossing problems posed by pervasive small and medium-sized gaps. If wheeled vehicles are used, the solution must depend upon the provision of relatively low cost, readily avail able assistance methods. These could take the form of a sufficiency of D-7-size tractor dozers with transporters; light-class, medium-length scissors bridges; or light, tracked combat engineer vehicles. Alternatively, a properly configured tracked tactical support vehicle would be relatively unrestricted by these gaps. Second, for terrain similar to that of the Mid-East study area, a suitably high level of ground mobility for forward area tactical support in intense combat could readily be achieved by a well-configured wheeled carrier.

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PREFACE

The study reported herein was conducted from January 1976 through December 1977 by the U. S. Army Engineer Waterways Experiment Station (WES) for the U. S. Army Transportation School of the U. S. Army Training and Doctrine Command (TRADOC) under DA Form 2544 CD 59-76 dated 28 October 1975 and Change 1 dated 10 June 1976.

The study was conducted under the general supervision of Messrs. W. G. Shockley, Chief, Mobility and Environmental Systems Laboratory (MESL) and A. A. Rula and E. S. Rush, former Chief and Chief, respectively, Mobility Systems Division (MSD), MESL and under the direct supervision of Mr. C. J. Nuttall, Chief, Mobility Research and Methodology Branch (MRMB), MSD, MESL. Mr. Richard B. Ahlvin, Data Handling Branch (DHB), MSD, MESL, and Mr. S. A. Williams, Mississippi State University, developed the several new computer programs. Mr. Ahlvin adapted other programs and assembled the overall computer process used. Messrs. D. D. Randolph, MRMB, R. P. Smith, DHB, and C. D. Currie were principally responsible for assembling and loading terrain data for processing and Mr. R. B. Temple, MRMB, for assembling the vehicle data required. The report was prepared by Mr. Nuttall. As of 1 October 1978 assignments of WES personnel were changed by reorganization, and the MSD was made a division of the Geotechnical Laboratory. The designations given above are appropriate for the period through the completion of the final draft report in April 1977.

Acknowledgement is made for the patient assistance of Mr. Joe McClure, U. S. Army Logistic Center (LOGC) and Mr. Dennis McPherson, U. S. Army Tranportation School during the long course of the study.

COL G. H. Hilt, CE, and COL J. L. Cannon, CE, successively served as Commander and Director of WES during the study and the preparation of the report. Mr. F. R. Brown was Technical Director.

CONTENTS

Conversion Factors, U. S. Customary to Metric (SI)
Units of Measurement

U. S. customary units of measurement used in this report can be converted to metric (SI) units as follows:

Multiply	By	To Obtain
degrees (angle)	0.01745329	radians
feet	0.3048	metres
gallons	3.785×10^{-3}	cubic metres
inches	2.54	centimetres
miles per hour (U. S. statute)	1.609344	kilometres per hour
pounds (force)	4.448222	newtons
tons	907.1847	kilograms

AN ASSESSMENT OF THE INLAND WATER CROSSING PERFORMANCE OF SELECTED TACTICAL SUPPORT VEHICLES (WACROSS)

PART I: INTRODUCTION

Background

1. World War II problems in Europe in maintaining ground vehicle combat momentum across water gaps and the success achieved in developing thin-skinned amphibian vehicles for use over beaches fostered a desire for, and expectations of, an automotive solution to the military vehicle inland water gap crossing problem. Some light, large-hulled combat vehicles, such as the M113 Armored Personnel Carrier (APC), proved relatively easy to make float. Others, such as the M551, Sheridan, Armored Reconnaissance Vehicle, required minor but troublesome adjuncts in order to float. Few swimming combat vehicles were competent for anything but near still-water conditions. For a while, serious work was devoted to water-fording kits for tanks that would permit them to walk across river bottoms in waters up to 8-10 m deep.

2. The same basic desire and hope, plus a perceived need to support still newer and better combat vehicles forecast to have remarkable new gap crossing capabilities, resulted in the 1960 MOVER study[1] recommendation that all future tactical support vehicles have a swimming capability. During the following several years, considerable Army resources were expended to follow the letter of this guidance, but the spirit was soon lost. Tactical vehicle development and some procurement and operating costs were ballooned to provide new and proposed new tactical support vehicles with a floating capability, but very little else needed to make swimming an operational reality was developed. Swimming speeds were low, freeboards were low, control behaviors in the water were marginal, streambank mobilities were marginal, and once afloat, egress was too often impossible except under ideal conditions, such as at a boat ramp.

3. By the early 1970's, the cost-effectiveness of the MOVER doctrine on vehicle swimming capabilities began to be questioned. In 1974, the Department of the Army (DA) commissioned the U. S. Army Concepts Analysis Agency (CAA) to reexamine the doctrine. In support of the CAA effort, the U. S. Army Engineer Waterways Experiment Station (WES) prepared simple stream-crossing statistics, based upon GO/NOGO crossing predictions for a parametric series of 48 "paper" vehicles on wheels and tracks and for five existing tracked combat vehicles having nominal swimming capability. The basic predictions were made using the WES SWIMCRIT model.[2] The gaps crossed in the simulations were those described in a study of European waterways conducted in 1969-1970 by WES in relation to tactical bridging problems.[3]

4. The predictions data base prepared by WES for the CAA study examined the total gap-crossing problem from bank to bank and put the problem in the perspective of frequency of encounter of potentially troublesome gaps of all sizes. (No consideration was given to relative tactical difficulties.) The data showed two things. First, when all gaps of all sizes were considered, the probability of a vehicle encountering a NOGO-crossing situation was very high. Second, gap for gap, small gaps--trivial appearing little streams and drainage ditches--as often resulted in immobilizations for a single unassisted vehicle as did large ones.

5. Table 1 presents, for the three tracked vehicles common to the CAA study and the present study, gap-crossing data for crossings described in the CAA study gap data base. The values shown were recomputed since that study on the assumption that all three vehicles were operated with track road pads removed. An excursion in the SWIMCRIT data indicated that tracked vehicle egress performance was seriously impaired by track road pads. Predictions for the present study were made on the assumption that road pads were removed consistent with the current doctrine, which states that road pads will be removed for combat, if given sufficient time. The data accordingly indicate the upper bound of possible performance. The percents of crossings that are GO are based upon simulated crossing attempts at three water stages all along

the total length of gaps (17,000 km) in the CAA study sample. Thus, they reflect no prior or on-the-spot reconnaissance to find and exploit the more suitable crossing places along a given gap line. This was considered to be a deficiency in the examination methodology used by WES to develop the data for CAA.

6. In the period 1974-1975, WES participated in the U. S. Army Training and Doctrine Command (TRADOC) High-Mobility Tactical Support Vehicles (HIMO) study.[4] The object of the HIMO study was to determine the proper place in the Army's tactical support fleet of high-mobility tactical support vehicles, represented largely by 1960's military vehicles, such as the M656, 5-Ton,* 8x8, cargo, relative to less costly, standard pattern military vehicles, such as the M813, 5-Ton, 6x6, cargo. In support of the HIMO study, WES prepared study quality, digitized maps depicting the areal terrain (forests, fields, hills, etc.), as well as roads and trails in a 3000-sq-km area in West Germany (Figure 1) and in a similar area in the Mid-East (Figure 2). These maps were in the quantitative terms required for exercise of the areal terrain and road performance prediction modules of the Army Mobility Model (AMM),[5,6] which between them deal with road, trail, and cross-country performance but not gap crossing. Vehicle cross-country and road performance predictions were made using these data and the AMC-74X version of AMM.[7]

7. Associated gap-crossing problems were handled in the final overall HIMO performance predictions only in preliminary fashion. The wet gaps, or blue-line map features, in the study areas were not explicitly mapped. Rather, areas were mapped on the basis of drainage basins and stream orders, and a reasonable, standard set of gap data was assigned to each resulting drainage basin/stream order map unit. Predictions of crossing times (including assistance when needed) for the study vehicles were made by U. S. Army Tank-Automotive Research and Development Command (TARADCOM) for each such standard gap using an early

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* A table of factors for converting U. S. customary units of measurement to metric (SI) units is presented on page 4.

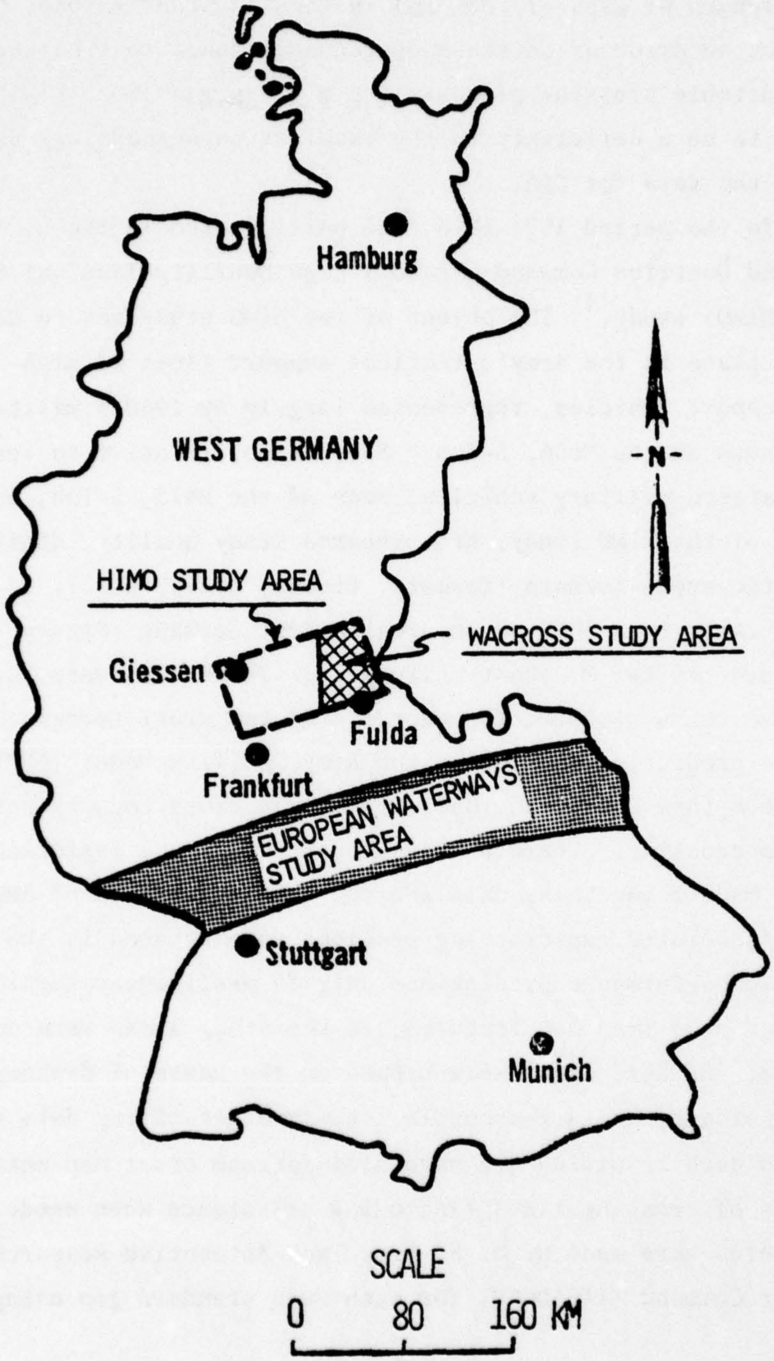

Figure 1. Study areas in West Germany

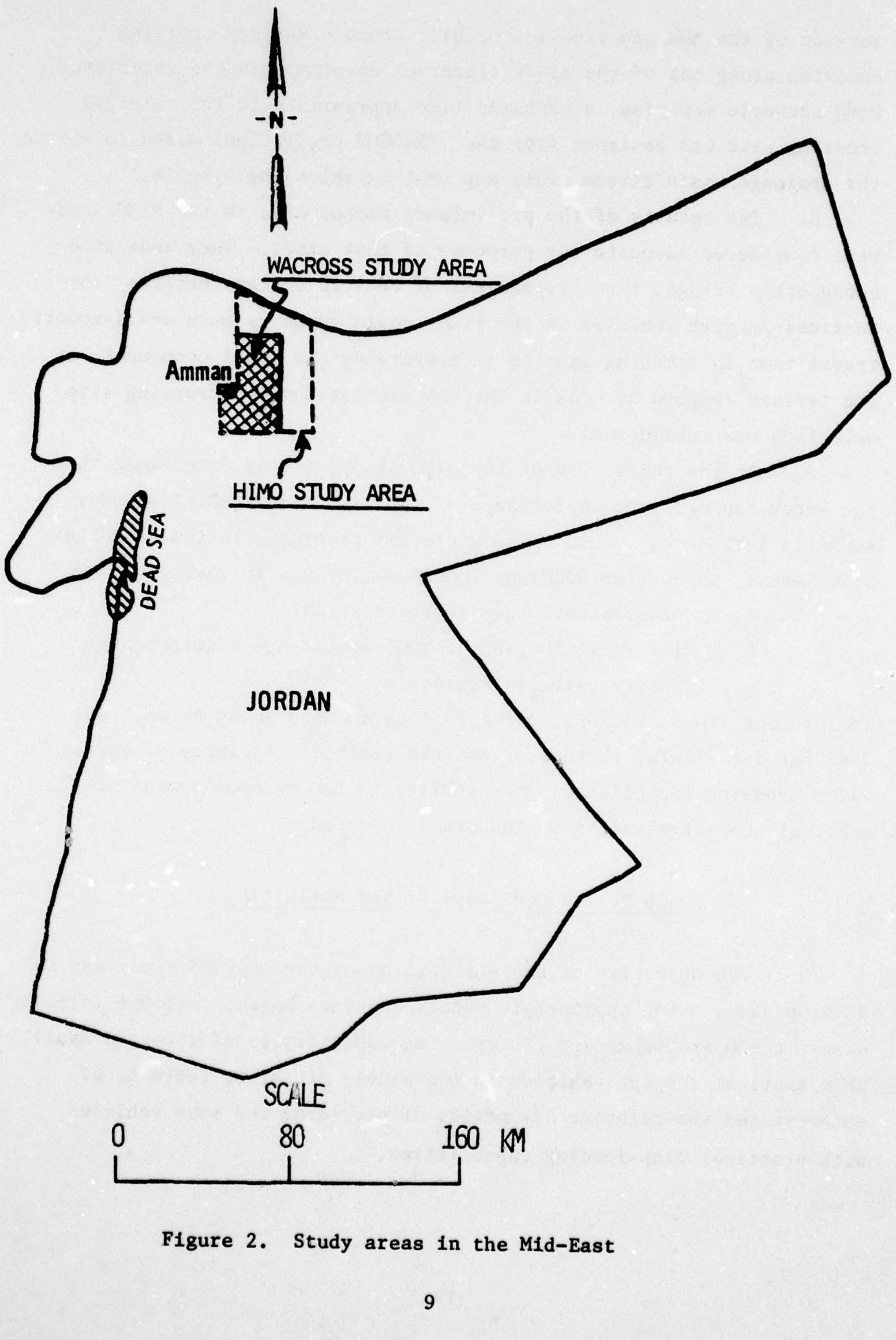

Figure 2. Study areas in the Mid-East

version of the AMM gap-crossing module. When a wet gap crossing occurred along one of the study traverses developed in the associated HIMO scenario map play, a crossing time appropriate to the selected crossing site was assigned from the TARADCOM predictions based solely on the drainage basin/stream order map unit in which the site fell.

8. The results of the preliminary method used in the HIMO study were considered adequate for purposes of that study. They indicated among other things, that, regardless of vehicle design features, the tactical support vehicles in the study could spend as much cross-country travel time in crossing gaps as in traversing the areal components of the terrain (Figure 3). As in the CAA simulations, no crossing site selection was considered.

9. At the conclusion of the HIMO study, it was determined that the water gap crossing performance of the HIMO study vehicles under scenario influences should be more closely examined, in the same basic study areas, using a methodology incorporating the following:

- a. More realistic gap representation.
- b. Closer examination of NOGO assistance requirements.
- c. Crossing site selection.

The present study, WACROSS, provides such an assessment as well as data for determining whether or not the limited efficiency of current water-crossing capabilities is essential to the accomplishment of tactical support missions in the areas selected.

Objective and Scope of WES Activities

10. The objective of the WES portion of the WACROSS study was to develop data, using appropriate models and data bases, that specifically assess the operational wet gap crossing capabilities of selected available tactical support vehicles in two widely differing terrains of interest and the relative advantages of providing the same vehicles with practical deep-fording capabilities.

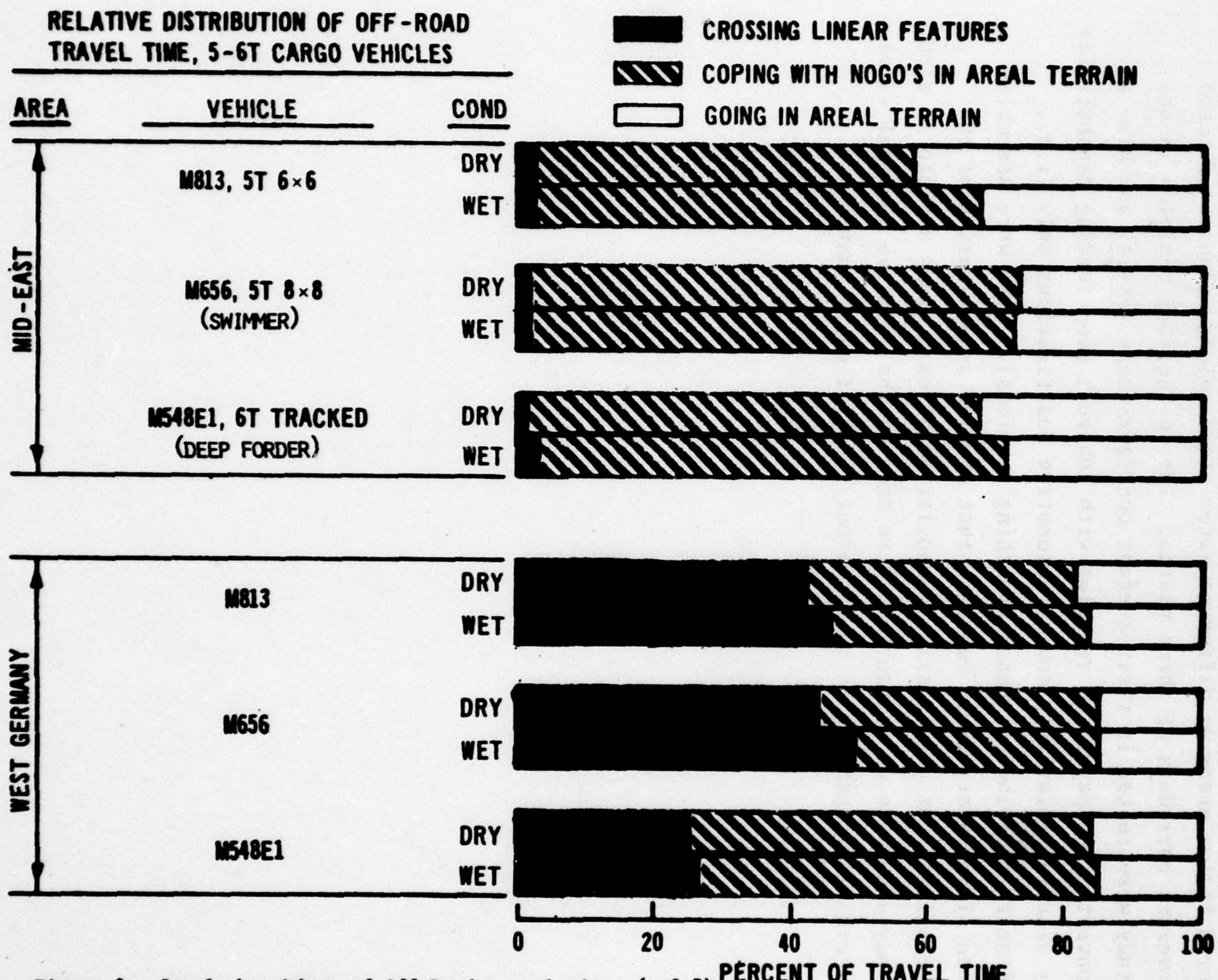

Figure 3. Sample breakdown of Off-Road travel times (ref 7).

11. Sixteen tactical support vehicles and four reference combat vehicles were tested in simulations of the gap-crossing problems encountered in two areas at different water stages along scenario oriented movement corridors of three widths. The 16 tactical vehicles in the study were tested in their current configurations (as-is) and also as converted, on paper, to vehicles with inherent deep-fording capabilities by assuming relatively modest automotive modifications only (i.e., without involving personnel breathing problems). Data were assembled into simple statistical measures that provide an evaluation of the operational wet gap crossing capabilities of each study vehicle in each study area. No considerations were made of the relative tactical value of crossing capabilities in different kinds of gap situations.

PART II: BASIC WES METHODOLOGY FOR THE WACROSS STUDY

12. Following identification by TRADOC of the study vehicles and study areas, the basic WES methodology was to:

a. Develop the more realistic data base on wet and intermittantly wet gaps required for the two areas (Appendix A).

b. Develop a method to use the WES SWIMCRIT model[2] and the Bridging Capabilities Module (BCM) of the WES STAFGAP simulation[8] to address vehicle crossing performance and assistance requirements from these gap data bases (Appendix B).

c. Develop a method to incorporate crossing site selection within specified movement corridors and general scenario influences (Appendix B).

d. Develop, in cooperation with personnel from several TRADOC elements, required simple scenario inputs and three technical (rather than tactical) measures of effectiveness (MOE's).

e. Assemble vehicle data required for making SWIMCRIT predictions (Appendix C).

f. Prepare computer predictions of the gap crossing performance and assistance requirements of each study vehicle in each area based upon water flow stage, movement axis, and allowable search distance from the axis (corridor width).

g. Compute, from the predictions data base, area-wide values for the selected MOE's, assessed the results, and prepared this report.

In the following paragraphs, study vehicles and areas and items a through g above are discussed briefly.

Study Vehicles

13. The 16 tactical support vehicles and 4 reference tracked combat vehicles examined in the study are identified in Table 2. They are the same vehicles as in the HIMO study with the exception of the M861, 1-1/4-Ton, 4x4, which replaces the M715E1, 1-1/4-Ton, 4x4, and three added reference vehicles. The HIMO study results showed that, from the point of view of road, trail, and areal cross-country mobility

and of first-cut gap crossing performance, the following vehicles were substantially the same within the resolution of the performance models used:

a. M35A2, 2-1/2-Ton, 6x6, cargo; and M49A2C, 2-1/2-Ton, 6x6, fuel service.

b. M813, 5-Ton, 6x6, cargo; M821, 5-Ton, 6x6, bridge transport; and M816, 5-Ton, 6x6, wrecker.

c. M520E1, 8-Ton, 4x4, cargo (GOER); M559, 2500 gal, 4x4, tanker; and M553, 10-Ton, 4x4, wrecker.

Accordingly, predictions and analyses were made only for the highest density item in each group (underlined above), reducing the effective number of study tactical vehicles to eleven. In all following discussions and tables, reference to any one of these three vehicles will implicitly include reference to the other vehicle(s) in the group for which it is surrogate.

14. Each of the resulting 11 study tactical vehicles was checked both as currently configured, or "as-is," and as converted, on paper, to a vehicle with "deep-fording" capabilities. For purposes of this study, and in order to treat deep-fording potentials simply and uniformly, the "deep-fording" depth for each vehicle was taken to be the still-water depth that just reached the driver's seat cushion when the driver's compartment was considered to be free-flooding. When converted for deep-fording, the M561, M656, and M520E1 vehicles, which are swimmers in their as-is configurations, were assumed to be free-flooding throughout their present watertight hulls.*

15. Characteristics and parameters of the study vehicles required to make crossing predictions using the SWIMCRIT model are shown in Appendix C. Values are given for each of the 11 study tactical support vehicles in both the as-is and deep-fording configurations and for the 4 reference vehicles in the as-is configuration only. Predictions for all tracked vehicles were made assuming that they were operating with track road pads removed.

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* The M548E1 with a 6-ton payload was considered to be a deep-forder, as-is.

Study Areas

16. The WACROSS study considered operations over the same two study areas that were used in the HIMO study, one in West Germany (Figure 1) and one in the Mid-East (Figure 2). The scenario play provided as study guidance, however, used only a portion of each full HIMO area as indicated in the figures. Gap data were prepared only for those parts of the HIMO areas actually used.

Gap Data for the Study Areas

17. Quantitative, relatively detailed data describing bank and cross-section dimensions and soils and seasonal stream depths and velocities for all stretches of all streams, rivers, and canals throughout the study areas are needed by the basic models. These were not available. Appendix A describes the largely computerized process that was developed in order to build for each of the two areas a study quality gap data base for purposes of this study. Essentially, the process identifies from available partial information at any given site an analogous site elsewhere for which the needed measurements are known. It then assigns values needed for the new site based upon those of the measured analog site plus some additional considerations such as overall network flows. Use of the process permits assignment at a reasonable resolution of a consistent set of values for the required cross section and hydrologic factors for every possible gap crossing shown on any basic source map.

18. For the WACROSS study, 1:50,000-scale topographic map sheets were used as basic source maps for gap location. The final product of the process is one or more gap location maps represented by rectangular

cells of a selected size* containing legend references and associated legends giving values for all needed gap factors.

19. Hydrologic data were developed for a year-round mean high stage, mean average stage, and mean low stage in the West Germany study area, and for a mean high stage (intermittent streams flowing) and a mean low stage (intermittent streams dry) in the Mid-East study area.

20. The gap data resulting from the process described in Appendix A, as applied at this time, must be considered to be of study quality only. Values assigned to describe any site were inferred from limited information by a logical but as yet unvalidated procedure, and no ground truth from the specific areas was used. As a result, there is no assurance that the specific set of gap factor values assigned for a given geographically located site will in fact be found at that location on the ground. It is considered, however, that the data development method assures that the complete data for each area represent to a reasonable degree for WACROSS study purposes the general levels, associations, and distributions of those gap factors important to vehicle crossing and tactical bridging.

21. Some statistical characteristics of the gaps as described in the data base are tabulated in Appendix D. These figures show in relation to the West Germany study area that the gaps described throughout the area are predominantly small and that water depths requiring swimming or deep-fording occur in only a few places. Ninety-two percent are less than 6 m wide and 1.5 m deep at high stage, and all are less than 6 by 1.5 m at low stage. Critical bank heights and slopes are largely in a range critical to the performance of wheeled vehicles. Seventy-eight percent of banks have angles at the waterline of more than

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* The cell resolution used was 127 m east-west by 105-5/6 m north-south on the ground. This cell size is the same used to similarly represent areal terrain factors (slopes, soils, etc.) for the HIMO study. This cell size permits rapid checking of the maps by using a standard high-speed computer printer to produce undistorted 1;25,000-scale maps of stored data in which two printer characters are available to show information related to each cell.

40 deg, while 69 percent have banks rising more than 1 m above the waterline. The gaps characterized for the Mid-East study area are generally minor with less than 1 percent of crossings over 2 m deep even during the high stage when all intermittent streams are flowing. Critical bank angles are all less than 40 deg.

SWIMCRIT and BCM

22. The WES SWIMCRIT model predicts GO or NOGO (with reasons for NOGO) when a specified vehicle attempts an unassisted gap crossing at a given crossing site and time (as reflected by water flow stage and associated bank and soil conditions). BCM, the Bridging Capabilities Module of the WES STAFGAP simulation predicts personnel and equipment required to emplace a given type of class 60 tactical bridge (Armored Vehicle Launched Bridge, Medium Girder Bridge, Ribbon Bridge, etc) or to prepare some other class 60 crossing site modification (ford or fill, for example) at a given crossing site and at the time needed once the required resources are available at the site. SWIMCRIT is used in the WACROSS computational methodology to make predictions of site- and stage-specific GO/NOGO and NOGO reasons for a given vehicle; BCM to predict site- and stage-specific placement times for a given type of crossing assistance. SWIMCRIT crossing NOGO's are divided into two classes: NOGO due to egress bank problems deriving from insufficient traction or clearances and NOGO for any other reason, with or without egress problems. When the results from SWIMCRIT and BCM are finally joined, every vehicle, site, and stage combination is identified either by a flag showing that it is an unassisted GO situation or by a number unique to a single selected assist option.

Scenario Influences

23. Selection of a type of assistance or assistance option for situations requiring that a vehicle be assisted in crossing is one of two principal scenario influences upon the study. Such selection is

based upon a SCORE table which will be discussed in the next four paragraphs. The second scenario influence is the specification of movement axes and corridor widths (paragraph 28).

24. The SCORE table is an important input to the overall WACROSS computational process. It performs two related functions in the computations. When a vehicle requires crossing assistance, the assigned scores establish priorities in the selection of a single assist option from among a number of options feasible at the given site. It also governs selection of a single site for crossing a given gap line along which there are available a number of sites associated with different assist options. In addition, the assigned scores determine the number of times that one higher priority (lower score) option will be called to avoid calling a single lower priority (higher score) option. The second feature of the scores controls such computer decisions during route selection as whether or not to cross two or more gaps each requiring a lower scored assistance rather than to cross a single gap requiring one higher scored assistance.

25. Table 3 lists the 16 assist options evaluated in the BCM model and the scores assigned to each. The first 12 options were considered available to meet the need for any type of NOGO assistance, including NOGO deriving solely from egress bank difficulties. The last four options were considered available to overcome egress bank problems only. Two scores are shown for each option. The first (SCORE 1) applies when the site-specific placement time predicted in BCM is less than the critical time shown; the second (SCORE 2), when placement time is greater.

26. Assignment of the final option scores was done at WES, following guidance that resulted from several days of informal consultation with knowledgeable personnel at The Engineer School. The substance of this guidance was that the study vehicles--tactical support vehicles in the tactical support role--would not be in the assault wave and hence would generally be unable to call upon rapid, assault bridging capabilites to assist their missions. Accordingly, the Armored Vehicle Launched Bridge (AVLB), for example, was so scored that at any given

site it would be the option selected only if it were the only option. The same high score assures that if there are other assist options available along a given gap line at other sites, one of the other sites will be chosen during route selection. The higher score assigned for assistance by the Universal Engineer Tractor (UET) in egress NOGO situations, as compared with use of a D-7 tractor-dozer, reflects the same idea; i.e., UET densities projected in 1976 indicated that these machines would not be as generally available as normal tractor-dozers to assist tactical support operation. Accordingly, and despite the fact that the UET could do all of the egress assistance jobs for which the D-7 was designated, the UET was specifically chosen only for those situations where water depths were such that the (deep-fording) D-7 could not reach the egress site, which was always assumed to be on the far side of the gap.

27. Assist option priorities assigned for the tactical support role evaluations are in general inversely related to nominal placement times. The priorities favor assist options requiring simple and/or high-density equipment, regardless of placement times, while those options that can be most rapidly emplaced once personnel and equipment are at the site are called upon only when others requiring less critical resources will not work.

28. All assist option scores as finally used are unique; i.e., each value for a score is used for only one option. This directly avoided simple tie-breaking problems and also allowed use of the score as the unambiguous identifier of the option selected at any point during the route selection process.

29. The second scenario influence on the study is the selection of movement corridors. Each movement corridor is defined in terms of the coordinates along an axis and of a corridor width extending one-half to each side of the axis. Detailed selection of movement corridors was made by WES, based upon general guidance in 1976 from the TRADOC SCORES Team[9] at The Engineer School. Seven east-west axes were defined in the West Germany study area and seven north-south axes were defined in the Mid-East study area, all generally following probable Main Supply Routes

(MSR's). Concern having been expressed about possible differences which might be associated with lateral movements relative to the assumed line of contact in the West Germany study area, six additional axes running north-south and again following probable MSR's within the area were defined for the West Germany study area (Figures 4 and 5). Three corridor widths centered upon the defined axes were examined, 1, 2, and 4 km, which cover the range of frontages normally assigned to various sized units up to a battalion.

Measures of Effectiveness

30. The basic WACROSS computations provide predictions as to whether or not a given vehicle can negotiate, unassisted, a gap at a given crossing site and water stage and of the time required to modify the gap to ease or permit crossing using each of a series of possible engineer procedures. Neither tactical considerations nor the availability of specific assistance resources at any given time is considered except in general terms through the relative scores assigned to the assist options. The corridor definition and analysis part of the WACROSS computations allows selection of crossing sites upon the basis of stated criteria deriving from the basic predictions and, once again, the score table. This part of the computations conceptually conducts a search along each gap line and along the movement corridor to find and use the most favorable crossing sites within the corridor from the viewpoint of overall assistance requirements.

31. A primary measure of vehicle effectiveness in crossing gaps is clearly the percent of those gap crossings selected as most suitable within an allowable search band or movement corridor that are negotiable by the vehicle without assistance. This index, hereinafter termed simply <u>Percent of Crossings GO</u>, is a function of the study area, water stage, and movement corridor width, as well as of vehicle characteristics. A related second measure that lends itself to more direct operational interpretation is the mean distance <u>along a corridor axis</u> between

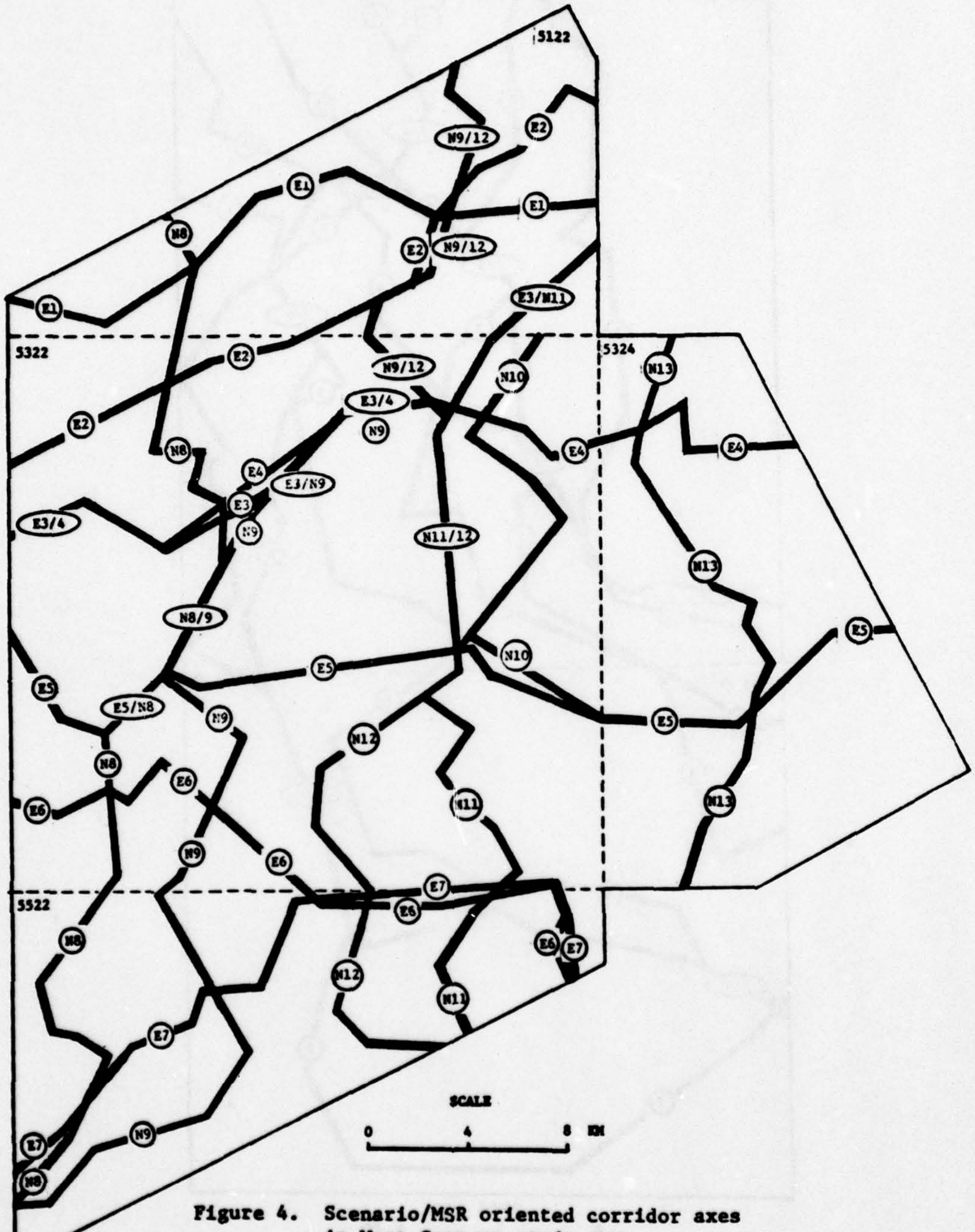

Figure 4. Scenario/MSR oriented corridor axes in West Germany study area

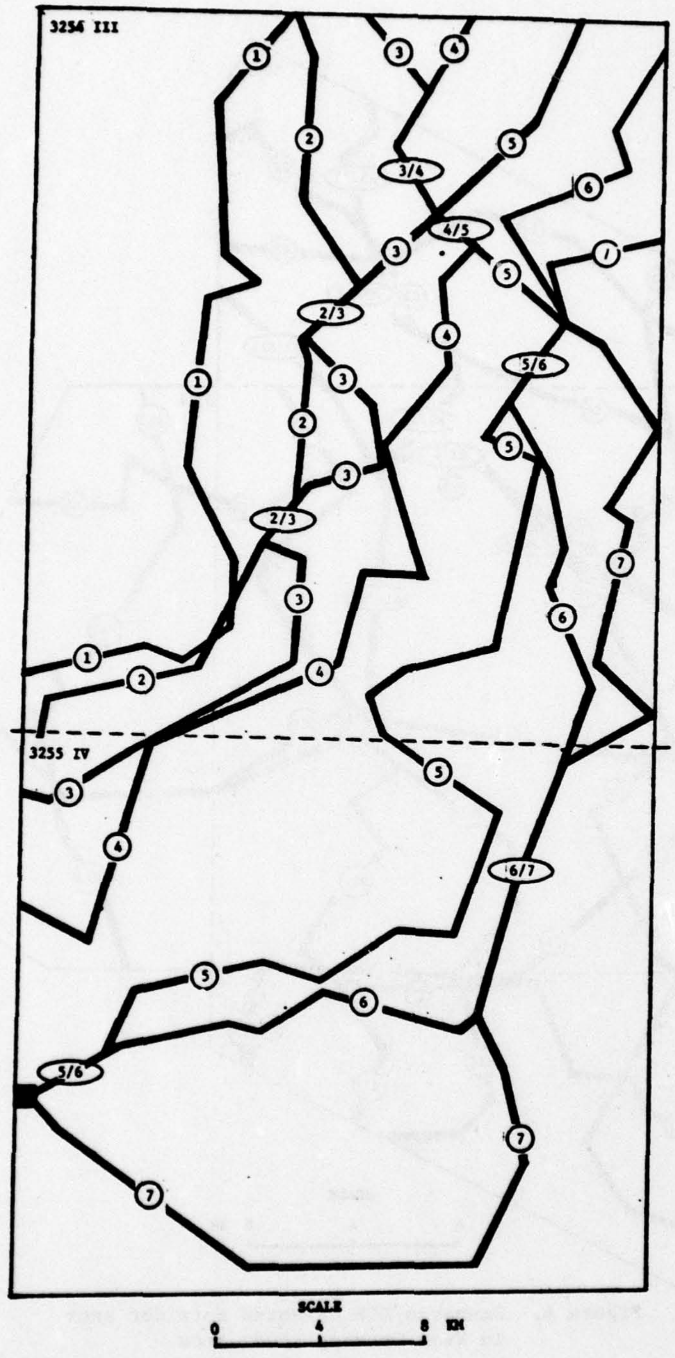

Figure 5. Scenario/MSR oriented corridor axes in Mid-East study area

crossings requiring some level of assistance, or Mean Kilometers per NOGO Crossing.

32. Two vehicles encountering a NOGO gap-crossing situation do not necessarily demand the same kind or degree of assistance. A non-swimmer, for example, may require a bridge where a deep-fording vehicle requires a lesser effort to prepare a ford and a swimming vehicle only some minor egress bank modification. Since the scores assigned to the several assist options are intended to indicate the relative level of demands for gap-crossing assistance associated with each vehicle, the total of all crossing scores for a vehicle along a corridor at selected crossings requiring assistance may be taken as a measure of the operational difficulties encountered by that vehicle in negotiating that corridor. The sum of all scores for one or more corridors divided by the total of all axis lengths in the sample, or Mean NOGO Penalty per Kilometer, is used as an index of the overall NOGO assistance level needed by a vehicle. This index reflects the total technical gap crossing performance of the vehicle, with and without assistance, within the framework of the scenario influences reflected in the scores assigned for the various assist options.

Two Further Basic Assumptions

33. In generating the mean values used as MOE indices all existing bridges and culverts in the study areas were removed and results from all axes at a given corridor width were pooled (paragraphs 37 and 38). This was done in order to obtain area-wide values based upon a reasonable number of crossings (approximately 100-200 in the West Germany study area, and 100-250 in the Mid-East study area, depending on corridor width). As a result, the Percent of Crossings GO figures indicate the probability of finding a GO crossing site on any gap line encountered at random, under the assumption that all bridges and culverts are equally likely to be out of service, regardless of the enemy's evaluation of the particular gap line as a tactically significant mobility barrier.

34. No consideration was given to vehicle performance--cross-country or on roads and trails--between gaps, or to relative crossing site accessibility to the engineer vehicles and equipment needed to effect each assist option, although BCM predictions of option feasibility and placement times reflect bankside trafficability conditions at the site per se. The underlying assumption, based upon discussions with experienced combat engineer officers, was that vehicle travel time between crossing sites was far less important operationally than exploiting a suitable crossing site. This assumption was consistent with the scope of the study, which did not extend to full operations simulations.

Preliminary Runs

35. Prior to making complete computer runs along the scenario-oriented corridors throughout the WACROSS study areas a number of preliminary runs were made to address two questions:

- a. To what extent are the results sensitive to the specific scenario-oriented corridors selected?
- b. To what extent are results a function of corridor orientation, i.e., east-west versus north-south?

To examine these questions, special runs were made across the largest single-map-sheet area within each of the two study areas. These runs were along approximately nine equally spaced straight-line axes in each direction. In each case two corridor widths, 1 and 3 km, were used.

36. Predictions were made of Percent of Crossings GO, Mean Penalty per Kilometer (all crossings), and Mean Kilometers per Crossing (all crossings) for each study vehicle in three water stages in the West Germany subarea and two stages in the Mid-East subarea. Mean values for these parameters for all stages and for all vehicles in each of three groups--as-is, deep-fording, and reference vehicles--are summarized in Tables 4 and 5 under the designation "transect." The same tables show corresponding figures from subsequent "scenario" corridor runs.

37. The figures in Tables 4 and 5 show that the effects of corridor width variations are important, as was to be expected. On the basis of close comparisons of the more detailed predictions, the general nature of which is well represented by the summary figures, two conclusions were drawn. First, it was concluded that for a given area the MOE indices were relatively insensitive to axis direction, i.e., there appeared to be only minor "grain" to the terrain in either area at the selected level of data aggregation. Second, it was concluded that the scenario-oriented corridors provided essentially the same results as the straight-line sample transect corridors and could therefore be considered to be applicable throughout the study areas without reference to details of the specific scenario axes used. The important corollary to this was the answer to question b in paragraph 35 above; i.e., the results would not have been greatly altered by selection of different scenario corridors provided that among them they sampled the entire study area in a reasonable manner.

38. The results for the West Germany study area presented and discussed in the following sections are based upon pooling all data from the scenario axes without regard to nominal axis direction. Because of the density and intermingling of the scenario axes in both study areas (Figures 4 and 5), some possible crossings and crossing sites are evaluated and perhaps selected two or more times in the total multiaxis sample at any given corridor width. No attempt was made to eliminate such duplications.

First Study Area Overviews

39. Vehicle-by-vehicle crossing GO/NOGO predictions using SWIMCRIT to simulate crossing attempts all along the total length of gaps in each study area (West Germany, 1260 km; Mid-East, 3760 km) are summarized in Tables 6 through 9. The tables show the Percent of Crossings that are GO in relation to three major events during each crossing:

a. Negotiating the (wet or dry) gap bottom by fording or swimming--"bottom crossing."

b. Encountering the bank as a potential obstacle from a clearance or interference viewpoint--"bank clearances."

c. Developing sufficient traction on the egress bank to exit from the gap--"egress traction."

All three events must be GO for a given crossing to be GO. The summary figures are for the pooled results for three water stages in the West Germany study area, two in the Mid-East area.

40. For ready comparison Table 6 includes a recapitulation of the corresponding results from the CAA study area already given in Table 1, and to assist in using the results to make a broad comparison of the CAA and WACROSS gap data bases, mean values for the five vehicles are also shown. Event-by-event comparison indicates that the magnitude of the bottom-crossing problems presented to tracked vehicles in the two data sets is the same, and in both cases relatively minor. Based upon the overall GO situation ("all three factors GO"), however, the gaps described in the WACROSS data base are generally somewhat more severe for tracked vehicles than those described in the CAA gap data base. Comparisons of performance against the two major components of egress operations, bank clearances, and egress traction indicate that the differences derive primarily from more severe bank geometry for the gaps in the WACROSS data base.

41. Tables 6 and 7 show that the overall gap crossing problem in the West Germany study area, despite the fact that there are no major rivers in the area, is difficult for tracked vehicles and severe for wheeled vehicles. For both classes of vehicles, egress problems predominate. Tables 8 and 9, on the other hand, indicate that, wet or dry, the gaps throughout the Mid-East study area do not present a serious problem to either class of vehicle.

PART III: WACROSS SIMULATION RESULTS

West Germany Study Area

42. Tables 10, 11, and 12 show values for the three selected MOE indices, Percent of Crossings GO, Mean NOGO Penalty per Kilometer, and Mean Kilometers per NOGO Crossing, based upon all scenario axes (431 km) for each of the 11 study vehicles as-is and in the deep-fording configuration and for the 4 reference vehicles, as-is.* Values are given at three water stages for movement corridor widths of one, two, and four km. These tables also show figures for all stages, based upon the assignment of an equal weight to each of the results from the three stages, and similarly for all vehicles in three groups--as-is, with deep-fording capabilities, and reference vehicles. The seperate values for east-west and north-south trending scenario corridors are given in Appendix E.

43. Tables 13, 14, and 15 present as backup information the relative levels of assistance required by the several vehicles (all stages and all scenario axes) for one-, two-, and four-km-wide movement corridors. The 16 detailed assist options listed in Table 3 have been placed in the 10 assistance type groups indicated in the first column of that table, and the percent is shown of all selected crossings for which no assistance or assistance of the level associated with each of the 10 groups is called upon.** The tables also show again the percent

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* Note that Percent of Crossings GO refers to the crossings selected within the specified corridor width. As corridor width increases, some crossings are avoided (Table 22), some of which may be GO crossings. This may leave a higher percentage of NOGO crossings, i.e., Percent of Crossing GO can legitimately decrease with increasing corridor width.

** In context of providing an assessment of NOGO difficulties encountered by the study vehicles, the distinction between egress NOGO situations requiring only dozing assistance (designated D-7 egress) and those requiring dozing plus a swimming dozer (designated UET egress) is maintained. In relation to an evaluation of the UET (which was not a purpose of the present study), it is considered that both classes of assistance could be supplied by the UET only (paragraph 26).

of selected crossings requiring no assistance--None (GO), and the percent where crossings were required despite the fact that neither the vehicle nor any of the options was suitable--NOGO. More detailed breakdowns by axis direction and by flow stage are given in Appendix E.

Mid-East Study Area

44. Tables 16, 17, and 18 show, for all of the scenario axes (which were all functionally oriented in a north-south direction), values for the three MOE indices for all of the study vehicles, each at the high water stage (intermittent streams flowing) and the low water stage (intermittent streams dry), again for three movement corridor widths. The tables once more show values for all stages and for all vehicles in the three subgroups.

45. Tables 19, 20, and 21 present the relative levels of assistance required for both stages. Breakdowns by high and low water stages are shown in Appendix F.

PART IV: ANALYSIS OF WACROSS SIMULATION RESULTS

46. The final WACROSS simulation results, summarized in Tables 10 through 21, confirm earlier observations. Movement corridor width strongly influences values for the three principal MOE's in both study areas for all vehicles (paragraph 37). Table 22, for example, shows that the mean axis distance between all crossings (unassisted plus assisted) reduces dramatically with increasing corridor width. This index, which is not highly vehicle dependent and hence is not one of the three final MOEs, indicates that operationally the density of all gaps, whether large or small, is roughly the same in the two study areas.

47. Table 23, which summarizes figures for Mean Kilometers per NOGO Crossing for all water stages in each of the two study areas, further substantiates the importance of corridor width. In addition, it shows (as did Tables 6 through 9) that the Mid-East study area is relatively free of gap crossing problems for either wheeled or tracked vehicles.* In the West Germany study area, however, wheeled vehicles regularly require gap-crossing assistance; tracked vehicles require assistance less often than the wheeled vehicles, but far more often than either type of vehicle in the Mid-East study areas. Table 24, Percent of Crossings GO (all stages), shows the same picture emphasizing that the wheeled vehicles are predicted to require some level of assistance in nearly all crossings in the West Germany study area.

Study Vehicles in the West Germany Study Area

48. The three final MOE's, Percent of Crossings GO, Mean NOGO Penalty per Kilometer, and Mean Kilometers per NOGO Crossing, tabulated for all study vehicles in Tables 10, 11, and 12, show that <u>for the West Germany study area</u> the gap-crossing performance of the M548E1, 6-Ton,

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* For purposes of Tables 23 and 24, values for the M548E1 are pooled with the four reference tracked vehicles rather than included with the study vehicles per se, all the rest of which are wheeled.

tracked cargo carrier is far and away better than that of any of the tactical support vehicles (all on wheels) examined in this study. The advantages conferred by its tracked configuration are amply confirmed by the predicted performances of the four reference combat vehicles (all on tracks).

49. The computed gap crossing performance of the XM723, MICV, is significantly better than that of the M113A2, APC. Both are swimmers. The performance of the M60A1, tank, which is not a swimmer, lies between the XM723 and the M113A2. This suggests that the swim capability per se is not highly critical to the predicted performances in the study area.

50. Among the wheeled study vehicles, either as-is or deep-fording (as defined in paragraph 14), differences are small. Ranked on the basis of the index Mean NOGO Penalty per Kilometer, which most completely reflects considerations both of GO/NOGO and of levels of assistance required, however, the following three vehicles appear to do best in their as-is configurations:

M520E1, 8-Ton, 4x4, cargo
M656, 5-Ton, 8x8, cargo
TDW901, 5-Ton, 8x8, cargo

51. Conferring nominal deep-fording capabilities on all study vehicles, while making strictly marginal changes in the MOE's, consistently increases Mean NOGO Penalty per Kilometer for the M561, M656, and M520E1, which were originally swimmers, and reduces it for the larger nonswimming vehicles. Ranked using this MOE index, the three best vehicles as deep-forders are the TDW901, M520E1, and M656.

52. The trends observable are generally in directions that match intuitive judgements of the situation, which is satisfactory. The study terrain gaps, on the other hand, appear somewhat severe from the viewpoint of wheeled vehicle performance. In light of this and of the small differences between any of the wheeled vehicles shown by the MOE's, attempts to make more detailed comparisons appear unprofitable.

53. Tables 13, 14, and 15 detail the types of assistance called upon by the study vehicles in the West Germany study area under the scenario constraints of the SCORE table (Table 3). The figures in the

tables are the percent of selected crossings for which each level of assistance was called upon. The figures shown are mean values for high, average, and low flow stages. (More detailed breakdowns by axis direction and flow stage are given in A~pendix E.) Several things are apparent. First, as a result of the rules of the SCORE table, no bridging was called for except some configurations of the Bailey Bridge, and the calls for them were few, disappearing for all except high stage conditions (Appendix E) when the corridor width increased to 4 km. Other scoring rules (reflecting assault operations, for example) would, of course, have exercised other and more bridge resources, but as already observed, the study area did not include any major rivers.

54. Second, it is clear from Tables 13, 14, and 15 that the principal source of calls for crossing assistance derives from difficulties with egress banks in situations where a deep-fording, D-7-size tractor-dozer could ford to the bank to modify it suitably.

Study Vehicles in the Mid-East Study Area

55. Tables 16, 17, and 18 present values for the three final MOE's. The Mid-East study area is characterized at the low water stage almost entirely by dry stream beds and nearly dry wadis and at the high stage by small, swift streams and flooded wadis. The figures show that neither stage poses a major operational gap crossing problem, particularly if crossing sites can be selected within a 4-km corridor. On that corridor width only the M861, 1-1/4-Ton, 4x4, cargo; the M813, 5-Ton, 6x6, cargo; and the M818/M125, 12-1/2-Ton, tractor semi-trailer rig appear to have any difficulties. While all differences are, as before, small, these same three vehicle configurations experience somewhat more difficulty than most of the other study vehicles in the 1- and 2-km-wide corridors as well. The figures also show that deep-fording in this particular area has little value, as might be expected.

56. Tables 16, 17, and 18 show the percent of all selected crossings in the Mid-East study area for which each vehicle configuration required each of 12 levels of assistance (including "none", for crossings

which were GO). Figures are mean values for the high and low stages (A~pendix F for separate stage values). While assistance is occasionaly needed, at no time did the north-south scenario-oriented corridors (in association with the SCORE table scenario rules) require any bridging, even at the high water stage on the most restrictive corridor width (1 km).

PART V: ASSESSMENT OF THE WACROSS STUDY METHODOLOGY

57. Despite the highly quantitative procedures used to develop the final WACROSS simulation results, the results are more or less dependent upon a number of constraints, judgments, assumptions, and methodology limitations. First of these, and perhaps the most important, the results apply only to <u>the specific study areas and to other analogous areas</u>. The West Germany study area. in particular, cannot be taken to represent all of West Germany. The North German plains, coastal, and more mountainous southern regions each present quite a different set of gap-crossing problems, as do areas traversed by major rivers. Some of the basic conclusions that may be drawn from the present study results may be true in some of these other major regions, but in the absence of further examination, this cannot be assumed. The situation is essentially the same when generalizing from Mid-East study area results to other areas in that part of the world.

58. Second, the study values assess only technical problems--terrain, vehicle, and equipment interactions--and do not derive from a full operational simulation. They do not reflect any tactical values, such as the relative difficulty in marshalling and maintaining crossing assistance at minor streams and at major streams that may be more likely targets for enemy interference.

59. Third, the study values reflect only generalized scenario influences appropriate to tactical support vehicles on tactical support missions. In selecting assistance options, for example, relatively simple methods and high-density equipment are called for rather than more sophisticated assault procedures, at the expense of total movement rates. The reference combat vehicles were examined under the same broad cenario rules. For the WACROSS study, these rules were embodied in a simple score table (paragraphs 24 through 26), which served the primary study purpose of quantifying levels of assistance required in NOGO crossing situations but did not reliably address bridging needs per se. For a bridging study, which WACROSS was <u>not</u>, more elaborate treatment of inventories, bridge retrieval, etc. (such as in the WES STAFGAP

simulation[8]), and perhaps consideration of travel times for all elements on the areal terrain and roads between gaps would be required.

60. Fourth, the results are sensitive to the detailed terrain data used for the two areas that were of study quality only for both areas (paragraph 20). Also, the route or site selection process used implies outstanding, perhaps omniscient, reconnaissance (Appendix B, paragraph 4, Step 10). Finally, the results reflect minor peculiarities and limitations of the models used and special interpretations of the predictions, such as use of the "best case" crossing prediction to approximate the presence of bank exit "windows" along a gap (Appendix B, paragraph 4, Step 2).

PART VI: SUMMARY INTERPRETATION OF THE RESULTS

61. With the caveats of paragraphs 57 through 60 in mind, it appears that the general observations concerning gap-crossing problems in West Germany made in paragraph 2 from the CAA study data[2] are valid despite the shift in study area and the introduction of site selection opportunities:

- a. When all gaps of all sizes are considered, the probability of a vehicle becoming immobilized during an attempted crossing is generally high for tracked vehicles, very high for wheeled vehicles.
- b. Gap-for-gap, small gaps and streams can be almost as apt to cause vehicle immobilizations as larger ones. This is particularly true for wheeled vehicles.

62. While the West Germany study area included no major water courses, it is generally analogous in topography, land use, and climate to areas lying between such larger barriers throughout the central highlands of West Germany. Thus, the findings may be considered applicable to that terrain as a whole, except that larger rivers where they cross would impose further problems.

63. From the data developed herein, it is apparent that the crossing of small- to medium-size gaps (between larger rivers) imposes serious limitations on the movement of tactical support vehicles in high-intensity combat conditions where bridges of all sizes would be targets. Effective tactical support under these conditions would seem to require solution of this problem.

64. Wheeled tactical support vehicles can cope with the small- to medium-size gaps only by having readily, rapidly available assistance, such as D-7-sized tractor dozers with suitable transporters, UET's, new light-class scissors bridges, or a new light-class, self-transporting combat engineer vehicle on tracks (perhaps based upon the stretched M113 chassis).

65. In the West Germany study area, more reliable gap-crossing performance is available from tracked carriers than from wheeled carriers, by a wide margin. The larger high-mobility tactical support

vehicles (M520E1, M656, TDW901) exhibit crossing performance superior to that of standard pattern vehicles, but far less than that of any of the track layers.

66. Based upon the data developed in this study, gap-crossing performance of the recently developed track laying XM723 MICV in the West Germany study area is approximately twice that of the older M113 APC. This indicates that for this and similar areas a tracked tactical support cargo carrier could now be developed for forward area use whose cross-country movement would be relatively unrestricted by gaps.* No similar opportunity is apparent for a comparable wheeled vehicle development.

67. For operations in terrain similar to that described for the West Germany study area, and like it having no major rivers, inherent vehicle swimming capability provides no appreciable gain in gap-crossing performance or reduction in assistance requirements. The simple deep-fording capability ascribed for study purposes to each of the study tactical support vehicles (paragraph 14) likewise buys very little additional performance or reduced assistance needs in such terrain.

68. The gap-crossing capabilities of current vehicles, both wheeled and tracked, in the Mid-East study area and in similar areas without any major water courses is basically satisfactory even at high water stages and especially when movement corridor widths of 2 to 4 km are available. Taken with the results of the HIMO study[7] concerning performance of the same tactical support trucks in the cross-country component of the same terrain this indicates that the ground performance of modern all-wheel-drive cross-country trucks on suitable tires would be satisfactory for forward area tactical support roles.

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* For still further technological opportunities, see also References 2, 11, and 12.

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Table 1

Percent of Crossings GO - All Stages, West Germany Study Area

Tracked Vehicles

	CAA Study* European Waterways Area (3)			
Vehicle	Bottom Crossing	Bank Clearances	Egress Traction	All Three Factors GO
M113A1, Armored Personnel Carrier	99	46	60	38
M551, Sheridan, Armored Reconnaissance Vehicle	99	43	78	37
XM723, Mechanized Infantry Combat Vehicle	99	92	81	80

NOTE: All vehicles are swimmers.

* Best case, without trees. Recomputed since CAA study reference 2 with track road pads removed.

Table 2

Vehicles in the WACROSS Study

Tactical Support Vehicles (16)

M151A2, 1/4-Ton Truck, Utility, 4x4

M861, 1-1/4-Ton (Commercial) Truck, Cargo, 4x4

M561, GAMA GOAT, 1-1/4-Ton Truck, Cargo, 6x6

M35A2, 2-1/2-Ton, Truck, Cargo, 6x6

*M49A2C, 2-1/2-Ton Truck, Fuel Service (1200/600-gal), 6x6

M813, 5-Ton Truck Cargo, 6x6

*M816, 5-Ton Truck, Wrecker, 6x6

*M821, 5-Ton Bridge Transport, 6x6

M656, 5-Ton Truck, Cargo, 8x8

M520E1, GOER, 8-Ton Truck, Cargo, 4x4

*M553, GOER, 10-Ton Truck, Wrecker, 4x4

*M559, GOER, 2500-gal Truck, Tanker, 4x4

M125E1, 10-Ton Truck, Cargo, 6x6

M818, 5-Ton Truck, Tractor, 6x6 with M127A1C, 12-Ton Semi-Trailer

TDW901, 8-Ton (Commercial) Truck, Cargo, 8x8

M548E1, 6-Ton Carrier, Cargo, Full-Tracked

Reference Vehicles (4)

M113A1, Armored Personnel Carrier, Full-Tracked

XM723, Mechanized Infantry Combat Vehicle, Full-Tracked

M551, Sheridan, Armored Reconnaissance Vehicle, Full-Tracked

M60A2, Tank, Combat, Full-Tracked

* See paragraph 13.

Table 3

Assist-Option SCORE Table

Assistance Type	Options	Basic SCORE (SCORE 1)	High SCORE (Score 2)	Use High SCORE If Placement Time >, hrs
	Full Assist Options			
FILL	1. Fill Gap	400	700	5
FORD	2. Prepare Ford	600	900	4
BAIL BRDG	Construct Bailey Bridge			
	3. - Single Span	1600	2100	6
	4. - Cable Reinf.	1800	2500	6
	5. - Multi-Span	2800	4100	12
RIBB	6. Use Ribbon Bridge	2400	2900	3
B/R	7. - Raft	2200	2700	2
MGB	Construct Medium Girder Bridge (MGB)			
	8. - Single Span	3000	4300	2
	9. - Multi-Span	4000	5500	2
MAB B/R	10. Use Mobile Assault Bridge (MAB)	5200	5700	1
	11. - Raft	5000	5300	1
AVLB	12. Use Armored Vehicle Launched Bridge (AVLB-18)	6800	9500	1
	Egress Assist Only Options (Egress Bank Modification Only)			
D7 EGRS	13. Use D-7 Tractor-Dozer, Deep Fording	200	300	2
UET EGRS	14. Use Universal Engineer Tractor (UET)	800	1000	2
	Use D-7, Raft across by			
RIBB S-R	15. - Single Ribbon Bridge Raft	1200	1700	2
MAB S-R	16. - Single MAB Raft	2000	2300	1

Table 4

Summary of Preliminary Runs*

West Germany Study Area

All Stages

		Scenario	Vehicle Group Means								
		or	As-Is			Deep Fording			Reference Vehicles		
Corridor Width, km	Axis Direction	Transect (S or T)	Percent GO	Penalty Per km	Km Per Crossing**	Percent GO	Penalty Per km	Km Per Crossing**	Percent GO	Penalty Per km	Km Per Crossing**
1	E-W	T	5	140	(2.9-4.0)	5	130	(2.9-4.0)	56	80	(2.9-4.0)
		S	5	121	2.4	5	117	2.4	57	77	2.4
	N-S	T	5	110	(1.8-2.2)	5	110	(1.8-2.2)	67	80	(1.8-2.2)
		S	4	115	2.1	4	111	2.1	59	81	2.1
	ALL	T	5	130	(2.2-2.9)	5	120	(2.2-2.9)	62	80	(2.2-2.9)
		S	4	118	2.2	4	114	2.2	58	79	2.2
2	E-W	S	4	75	3.7	4	71	3.7	62	41	3.5
	N-S	S	5	66	3.4	5	65	3.4	62	48	3.2
	ALL	S	5	70	3.6	5	68	3.6	62	45	3.3
3	E-W	T	5	90	(2.2-2.9)	5	80	(2.2-2.9)	52	30	(2.2-2.9)
	N-S	T	6	40	(2.2-2.9)	5	40	(2.2-2.9)	72	40	(2.9-4.0)
	ALL	T	5	60	(2.2-2.9)	5	60	(2.2-2.9)	63	30	(2.2-2.9)
4	E-W	S	6	60	5.0	6	55	5.0	69	28	4.8
	N-S	S	6	40	5.2	6	40	5.2	70	26	4.9
	ALL	S	6	50	5.1	6	47	5.1	70	27	4.9

* Table includes:
- scenario versus transect corridors
- axis direction effects
- corridor width effects

** Km/crossing in transect runs was originally output as crossings/km to the nearest 0.1. Values in ( ) show resulting range of values for the reciprocal.

Table 5

Summary of Preliminary Runs* - All Stages, Mid-East Study Area

Corridor Width, km	Axis Direction	Scenario or Transect (S or T)	As-Is Percent GO	As-Is Penalty Per km	As-Is Km Per Crossing	Deep-Fording Percent GO	Deep-Fording Penalty Per km	Deep-Fording Km Per Crossing	Reference Vehicles Percent GO	Reference Vehicles Penalty Per km	Reference Vehicles Km Per Crossing
1	N-S	S	94	94	1.4	94	94	1.4	98	87	1.4
		T	89	126	1.4	89	121	1.4	95	104	1.4
	E-W	T	92	82	1.6	92	80	1.6	96	75	1.6
	ALL	T	90	110	1.5	90	107	1.5	96	94	1.5
2	N-S	S	97	39	2.7	97	39	2.7	99	37	2.7
3	N-S	T	94	31	3.4	95	31	3.4	99	29	3.5
	E-W	T	98	29	3.6	98	28	3.6	100	26	3.8
	ALL	T	95	30	3.5	96	30	3.5	99	28	3.6
4	N-S	S	99	21	4.8	99	21	4.8	100	20	4.9

* Table includes:
- scenario versus transect corridors
- axis direction effects
- corridor width effects

Table 6

Percent of Crossings GO* - All Stages, West Germany Study Areas

Tracked Vehicles**

	CAA Study European Waterways Area (3)				WACROSS HIMO Area (East)			
Vehicle	Bottom Crossing	Bank Clearances	Egress Traction	All Three Factors GO	Bottom Crossing	Bank Clearances	Egress Traction	All Three Factors GO
M548E1 (D)†	99	39	69	32	99	28	41	28
M113A1 (S)††	99	46	60	38	98	32	37	28
M551 (S)	99	43	78	37	98	42	58	39
XM723 (S)	99	92	81	80	99	74	58	58
M60A1	95	48	78	38	95	49	64	45
Five-Vehicle Average	98	54	73	45	98	45	52	40

* Best case, without trees.
** All vehicles with track road pads removed.
† (D) Deep-Forder.
†† (S) Swimmer.

Table 7

Percent of Crossings GO - All Stages, West Germany Study Area

Wheeled Study Vehicles

	Vehicle As-Is				Vehicle with Deep-Fording			
Vehicle	Bottom Crossing	Bank Clearances	Egress Traction	All Three Factors GO	Bottom Crossing	Bank Clearances	Egress Traction	All Three Factors GO
M151A2	85	0	2	0	85	0	2	0
M861	89	0	0	0	89	0	0	0
M561*	95	18	1	0	94	18	1	0
M35A2	92	26	5	1	95	26	5	1
M813	92	10	1	0	95	10	1	0
M656*	96	29	6	2	96	29	6	2
M520E1*	96	35	8	4	97	35	8	4
M127E1	92	26	0	0	96	26	0	0
M818/M125	92	10	4	0	96	10	4	0
TD901	96	36	1	1	98	36	1	1

* Swimmer As-Is.

Table 8

Percent of Crossings GO - Both Stages, Mid-East Study Area

Tracked Study Vehicles

Vehicle	Vehicle As-Is: Bottom Crossing	Bank Clearances	Egress Traction	All Three Factors GO
M548E1*	100	90	100	90
Reference Vehicles				
M113A2**	100	96	100	95
XM723**	98	100	100	98
M551**	99	96	100	95
M60A1	99	100	99	98

* Deep-forder, As-Is.
** Swimmer.

Table 9

Percent of Crossings GO - Both Stages, Mid-East Study Area

Wheeled Study Vehicles

	Vehicle As-Is				Vehicle with Deep-Fording			
Vehicle	Bottom Crossing	Bank Clearances	Egress Traction	All Three Factors GO	Bottom Crossing	Bank Clearances	Egress Traction	All Three Factors GO
M151A2	96	92	97	90	96	92	97	90
M861	97	71	93	70	97	71	93	70
M561*	98	99	97	95	98	99	97	95
M35A2	98	99	97	95	98	99	97	95
M813	98	93	97	90	98	93	97	90
M656*	99	99	97	96	99	99	97	96
M520E1*	99	99	97	95	99	99	97	95
M125E1	98	99	92	90	99	99	92	91
M818/M125	98	93	97	90	99	93	98	90
TD901	99	100	93	92	99	100	93	92

* Swimmer As-Is.

TABLE 10

CROSSING PERFORMANCE STATISTICS
WACROSS WEST GERMANY ALL AXIS

CORRIDOR WIDTH: 1.0 KM   AXIS LENGTH: 431.2 KM

FLOW STAGE	PERCENT OF CROSSINGS GO HIGH	AVER	LOW	ALL	MEAN NO-GO PENALTY PER KILOMETER HIGH	AVER	LOW	ALL	MEAN KILOMETERS PER NO-GO CROSSING HIGH	AVER	LOW	ALL
VEHICLES AS-IS												
M151A2	0	0	0	0	161	126	99	129	2.2	2.3	2.3	2.2
M861	0	0	0	0	157	125	99	127	2.2	2.3	2.3	2.3
*M561	0	0	0	0	144	110	98	117	2.2	2.3	2.3	2.3
M35A2	0	0	1	0	149	125	98	124	2.2	2.3	2.3	2.3
M813	0	0	0	0	149	125	98	124	2.2	2.3	2.3	2.3
*M656	1	1	6	2	137	109	92	113	2.2	2.3	2.4	2.3
*M520E1	7	7	4	6	131	104	94	110	2.4	2.4	2.3	2.4
M125E1	0	0	0	0	149	125	98	124	2.2	2.3	2.3	2.3
M818/M125	0	0	0	0	149	125	98	124	2.2	2.3	2.3	2.3
TD901	1	1	4	2	138	109	94	114	2.2	2.3	2.4	2.3
M548E1**	40	36	40	39	62	78	63	67	3.7	3.4	3.7	3.6
ALL	4	4	5	4	139	114	94	116	2.3	2.4	2.4	2.4
VEHICLES WITH DEEP FORDING												
M151A2	0	0	0	0	161	126	99	129	2.2	2.3	2.3	2.2
M861	0	0	0	0	157	125	99	127	2.2	2.3	2.3	2.3
*M561	0	0	0	0	146	110	98	118	2.3	2.3	2.3	2.3
M35A2	0	0	1	0	144	110	97	117	2.2	2.3	2.3	2.2
M813	0	0	0	0	144	110	97	117	2.2	2.3	2.3	2.2
*M656	0	1	6	2	139	109	92	114	2.2	2.3	2.4	2.3
*M520E1	7	7	4	6	130	104	94	109	2.4	2.4	2.3	2.4
M125E1	0	0	0	0	130	110	97	112	2.2	2.3	2.3	2.2
M818/M125	0	0	0	0	134	110	97	114	2.2	2.3	2.3	2.2
TD901	1	1	4	2	119	109	94	108	2.2	2.3	2.4	2.3
M548E1**	40	36	40	39	62	78	63	67	3.7	3.4	3.7	3.6
ALL	4	4	5	4	133	109	93	112	2.3	2.4	2.4	2.3
VEHICLES FOR REFERENCE												
*M113A2	38	37	41	39	69	77	61	69	3.5	3.5	3.8	3.6
*XM723	71	74	77	74	42	43	30	38	7.7	8.8	9.6	8.6
*M551	58	49	54	54	51	67	50	56	5.2	4.3	4.8	4.7
M60A1	62	65	68	65	54	52	38	48	5.9	6.3	7.0	6.4
ALL	57	56	60	58	54	60	45	53	5.1	5.0	5.6	5.2

*SWIMMER
**DEEP FORDING AS-IS

TABLE 11

CROSSING PERFORMANCE STATISTICS
WACROSS WEST GERMANY ALL AXIS

CORRIDOR WIDTH: 2.0 KM. AXIS LENGTH: 431.2 KM.

FLOW STAGE	PERCENT OF CROSSINGS GO HIGH	AVER	LOW	ALL	MEAN NO-GO PENALTY PER KILOMETER HIGH	AVER	LOW	ALL	MEAN KILOMETERS PER NO-GO CROSSING HIGH	AVER	LOW	ALL
VEHICLES AS-IS												
M151A2	0	0	0	0	104	77	57	79	3.2	3.7	3.7	3.5
M861	0	0	0	0	99	75	57	77	3.3	3.7	3.7	3.6
*M561	0	0	0	0	90	74	57	73	3.4	3.8	3.6	3.6
M35A2	0	0	0	0	91	75	57	74	3.4	3.7	3.6	3.6
M813	0	0	0	0	91	75	57	74	3.4	3.7	3.6	3.6
*M656	1	1	3	2	82	59	55	65	3.5	3.7	3.7	3.7
*M520E1	8	9	2	6	83	55	55	64	3.6	4.1	3.7	3.8
M125E1	0	0	0	0	91	75	57	74	3.4	3.7	3.6	3.6
M818/M125	0	0	0	0	91	75	57	74	3.4	3.7	3.6	3.6
TD901	0	0	8	3	83	60	52	65	3.4	3.7	4.0	3.7
M548E1**	39	38	43	40	39	39	33	37	5.5	5.5	6.2	5.7
ALL	4	5	5	5	86	67	54	69	3.5	3.9	3.8	3.7
VEHICLES WITH DEEP FORDING												
M151A2	0	0	0	0	104	77	57	79	3.2	3.7	3.7	3.5
M861	0	0	0	0	99	75	57	77	3.3	3.7	3.7	3.6
*M561	0	0	0	0	90	74	57	74	3.4	3.8	3.6	3.6
M35A2	0	0	0	0	90	60	56	68	3.4	3.7	3.6	3.6
M813	0	0	0	0	88	60	56	68	3.4	3.7	3.6	3.6
*M656	0	1	3	1	84	59	55	66	3.4	3.7	3.7	3.6
*M520E1	8	9	2	6	82	55	55	64	3.6	4.1	3.7	3.8
M125E1	0	0	0	0	84	60	56	67	3.4	3.7	3.6	3.6
M818/M125	0	0	0	0	85	60	56	67	3.4	3.7	3.6	3.6
TD901	0	0	8	3	79	60	52	63	3.4	3.7	4.0	3.7
M548E1**	39	38	43	40	39	39	33	37	5.5	5.5	6.2	5.7
ALL	4	5	5	5	84	62	54	66	3.5	3.9	3.8	3.7
VEHICLES FOR REFERENCE												
*M113A2	38	38	46	41	41	39	32	37	5.3	5.6	6.5	5.8
*XM723	73	73	75	74	20	20	16	19	12.0	13.1	13.9	12.9
*M551	66	57	64	62	25	31	23	26	9.4	7.3	9.0	8.5
M60A1	69	69	73	71	25	23	17	21	10.3	11.1	12.7	11.2
ALL	62	59	65	62	28	28	22	26	8.4	8.3	9.6	8.7

*SWIMMER
**DEEP FORDING AS-IS

TABLE 12

CROSSING PERFORMANCE STATISTICS
WACROSS WEST GERMANY ALL AXIS

CORRIDOR WIDTH: 4.0 KM. AXIS LENGTH: 431.2 KM.

FLOW STAGE	PERCENT OF CROSSINGS GO HIGH	AVER	LOW	ALL	MEAN NO-GO PENALTY PER KILOMETER HIGH	AVER	LOW	ALL	MEAN KILOMETERS PER NO-GO CROSSING HIGH	AVER	LOW	ALL
VEHICLES AS-IS												
M151A2	0	0	0	0	76	57	38	57	4.7	5.2	5.3	5.1
M861	0	0	0	0	71	56	38	55	4.9	5.3	5.3	5.2
*M561	0	0	0	0	66	54	38	53	5.0	5.5	5.3	5.2
M35A2	0	0	1	0	67	56	38	54	4.9	5.3	5.3	5.2
M813	0	0	0	0	67	56	38	54	4.9	5.3	5.3	5.2
*M656	2	1	1	2	59	40	37	45	5.2	5.3	5.4	5.3
*M520E1	2	5	1	3	64	38	37	46	4.7	5.5	5.4	5.2
M125E1	0	0	0	0	67	56	38	54	4.9	5.3	5.3	5.2
M818/M125	0	0	0	0	67	56	38	54	4.9	5.3	5.3	5.2
TD901	0	0	9	3	61	40	34	45	5.1	5.3	5.9	5.4
M548E1**	54	52	66	57	19	21	14	18	10.5	10.0	14.4	11.3
ALL	5	6	8	6	62	48	35	49	5.2	5.6	5.7	5.5
VEHICLES WITH DEEP FORDING												
M151A2	0	0	0	0	76	57	38	57	4.7	5.2	5.3	5.1
M861	0	0	0	0	71	56	38	55	4.9	5.3	5.3	5.2
*M561	0	0	0	0	66	54	38	53	5.0	5.5	5.3	5.2
M35A2	0	1	1	1	66	40	37	48	5.0	5.3	5.4	5.2
M813	0	0	0	0	66	40	38	48	5.1	5.3	5.3	5.2
*M656	0	1	1	1	61	40	37	46	5.2	5.3	5.4	5.3
*M520E1	2	5	1	3	63	38	37	46	4.7	5.5	5.4	5.2
M125E1	0	0	0	0	61	40	38	46	4.9	5.3	5.3	5.2
M818/M125	0	0	0	0	61	40	38	46	4.9	5.3	5.3	5.2
TD901	0	0	9	3	57	40	34	44	5.0	5.3	5.9	5.4
M548E1**	54	52	66	57	19	21	14	18	10.5	10.0	14.4	11.3
ALL	5	6	8	6	61	43	35	46	5.2	5.6	5.7	5.5
VEHICLES FOR REFERENCE												
*M113A2	50	50	68	56	21	22	13	19	9.4	9.6	15.4	10.9
*XM723	76	77	85	79	10	11	6	9	20.5	22.7	33.2	24.4
*M551	66	63	79	69	14	17	9	13	14.4	12.3	22.7	15.4
M60A1	70	73	83	75	12	13	6	11	16.6	18.7	30.8	20.5
ALL	65	65	79	70	14	16	9	13	14.0	14.1	23.3	16.2

*SWIMMER
**DEEP FORDING AS-IS

TABLE 13

RELATIVE LEVEL OF ASSISTANCE LEVELS REQUIRED
WACROSS WEST GERMANY ALL AXIS

CORRIDOR WIDTH: 1.0 KM. AXIS LENGTH: 431.2 KM.
FLOW STAGE: ALL

ASSIST REQD	PERCENT NONE (GO)	D7 EGRS	FILL FORD	WET EGRS	RIBB S-R	MAB S-R	BAIL BRDG	RIBB B/R	MGB	MAB B/R	AVLB	NOGO
VEHICLES AS-IS												
M151A2	0	89	9	0	0	0	2	0	0	0	0	0
M861	0	91	7	0	0	0	2	0	0	0	0	0
*M561	0	95	4	0	0	0	2	0	0	0	0	0
M35A2	0	93	4	0	0	0	2	0	0	0	0	0
M813	0	93	4	0	0	0	2	0	0	0	0	0
*M656	2	94	2	0	0	0	2	0	0	0	0	0
*M520E1	6	90	3	0	0	0	1	0	0	0	0	0
M125E1	0	93	4	0	0	0	2	0	0	0	0	0
M818/M125	0	93	4	0	0	0	2	0	0	0	0	0
TD901	2	94	3	0	0	0	2	0	0	0	0	0
M548E1**	39	59	2	0	0	0	1	0	0	0	0	0
ALL	4	89	4	0	0	0	2	0	0	0	0	0
VEHICLES WITH DEEP FORDING												
M151A2	0	89	9	0	0	0	2	0	0	0	0	0
M861	0	91	7	0	0	0	2	0	0	0	0	0
*M561	0	94	4	0	0	0	2	0	0	0	0	0
M35A2	0	95	3	0	0	0	2	0	0	0	0	0
M813	0	95	3	0	0	0	2	0	0	0	0	0
*M656	2	94	3	0	0	0	2	0	0	0	0	0
*M520E1	6	90	3	0	0	0	1	0	0	0	0	0
M125E1	0	96	3	0	0	0	1	0	0	0	0	0
M818/M125	0	96	3	0	0	0	1	0	0	0	0	0
TD901	2	95	2	0	0	0	1	0	0	0	0	0
M548E1**	39	59	2	0	0	0	1	0	0	0	0	0
ALL	4	90	4	0	0	0	1	0	0	0	0	0
VEHICLES FOR REFERENCE												
*M113A2	39	59	2	0	0	0	1	0	0	0	0	0
*XM723	74	23	2	0	0	0	1	0	0	0	0	0
*M551	54	43	2	0	0	0	1	0	0	0	0	0
M60A1	65	31	3	0	0	0	1	0	0	0	0	0
ALL	58	39	2	0	0	0	1	0	0	0	0	0

*SWIMMER
**DEEP FORDING AS-IS

TABLE 14

RELATIVE LEVEL OF ASSISTANCE LEVELS REQUIRED
ACROSS WEST GERMANY ALL AXIS

CORRIDOR WIDTH: 2.0 KM. AXIS LENGTH: 431.2 KM.
FLOW STAGE: ALL

ASSIST REQD	PERCENT NONE (GO)	D7 EGRS	FILL FORD	UET EGRS	RIBB S-R	MAB S-R	BAIL BRDG	RIBB B/R	MGB	MAB B/R	AVLB	NOGO
VEHICLES AS-IS												
M151A2	0	89	10	0	0	0	1	0	0	0	0	0
M861	0	91	8	0	0	0	1	0	0	0	0	0
*M561	0	95	4	0	0	0	1	0	0	0	0	0
M35A2	0	94	5	0	0	0	1	0	0	0	0	0
M813	0	94	5	0	0	0	1	0	0	0	0	0
*M656	2	95	3	0	0	0	1	0	0	0	0	0
*M520E1	6	90	3	0	0	0	1	0	0	0	0	0
M125E1	0	94	5	0	0	0	1	0	0	0	0	0
M818/M125	0	94	5	0	0	0	1	0	0	0	0	0
TD901	3	94	3	0	0	0	1	0	0	0	0	0
M548E1**	40	59	1	0	0	0	0	0	0	0	0	0
ALL	5	90	5	0	0	0	1	0	0	0	0	0
VEHICLES WITH DEEP FORDING												
M151A2	0	89	10	0	0	0	1	0	0	0	0	0
M861	0	91	8	0	0	0	1	0	0	0	0	0
*M561	0	95	5	0	0	0	1	0	0	0	0	0
M35A2	0	96	4	0	0	0	1	0	0	0	0	0
M813	0	96	4	0	0	0	1	0	0	0	0	0
*M656	1	95	3	0	0	0	1	0	0	0	0	0
*M520E1	6	90	3	0	0	0	1	0	0	0	0	0
M125E1	0	96	3	0	0	0	1	0	0	0	0	0
M818/M125	0	96	3	0	0	0	1	0	0	0	0	0
TD901	3	95	2	0	0	0	1	0	0	0	0	0
M548E1**	40	59	1	0	0	0	0	0	0	0	0	0
ALL	5	91	4	0	0	0	1	0	0	0	0	0
VEHICLES FOR REFERENCE												
*M113A2	41	58	1	0	0	0	0	0	0	0	0	0
*XM723	74	24	2	0	0	0	0	0	0	0	0	0
*M551	62	36	1	0	0	0	0	0	0	0	0	0
M60A1	71	27	2	0	0	0	0	0	0	0	0	0
ALL	62	36	2	0	0	0	0	0	0	0	0	0

*SWIMMER
**DEEP FORDING AS-IS

TABLE 15

RELATIVE LEVEL OF ASSISTANCE LEVELS REQUIRED
WACROSS WEST GERMANY ALL AXIS

CORRIDOR WIDTH: 4.0 KM. AXIS LENGTH: 431.2 KM.
FLOW STAGE: ALL

ASSIST REQD	PERCENT NONE (GO)	D7 EGRS	FILL FORD	UET EGRS	RIBB S-R	MAB S-R	BAIL BRDG	RIBB B/R	MGB	MAB B/R	AVLB	NOGO
VEHICLES AS-IS												
M151A2	0	89	11	0	0	0	0	0	0	0	0	0
M861	0	92	8	0	0	0	0	0	0	0	0	0
*M561	0	95	5	0	0	0	0	0	0	0	0	0
M35A2	0	94	6	0	0	0	0	0	0	0	0	0
M813	0	94	6	0	0	0	0	0	0	0	0	0
*M656	2	96	2	0	0	0	0	0	0	0	0	0
*M520E1	3	95	2	0	0	0	0	0	0	0	0	0
M125E1	0	94	6	0	0	0	0	0	0	0	0	0
M818/M125	0	94	6	0	0	0	0	0	0	0	0	0
TD901	3	94	3	0	0	0	0	0	0	0	0	0
M548E1**	57	42	1	0	0	0	0	0	0	0	0	0
ALL	6	89	5	0	0	0	0	0	0	0	0	0
VEHICLES WITH DEEP FORDING												
M151A2	0	89	11	0	0	0	0	0	0	0	0	0
M861	0	92	8	0	0	0	0	0	0	0	0	0
*M561	0	95	5	0	0	0	0	0	0	0	0	0
M35A2	1	95	4	0	0	0	0	0	0	0	0	0
M813	0	96	4	0	0	0	0	0	0	0	0	0
*M656	1	96	3	0	0	0	0	0	0	0	0	0
*M520E1	3	95	2	0	0	0	0	0	0	0	0	0
M125E1	0	96	3	0	0	0	0	0	0	0	0	0
M818/M125	0	96	3	0	0	0	0	0	0	0	0	0
TD901	3	95	2	0	0	0	0	0	0	0	0	0
M548E1**	57	42	1	0	0	0	0	0	0	0	0	0
ALL	6	89	4	0	0	0	0	0	0	0	0	0
VEHICLES FOR REFERENCE												
*M113A2	56	43	1	0	0	0	0	0	0	0	0	0
*XM723	79	20	1	0	0	0	0	0	0	0	0	0
*M551	69	30	1	0	0	0	0	0	0	0	0	0
M60A1	75	24	1	0	0	0	0	0	0	0	0	0
ALL	70	29	1	0	0	0	0	0	0	0	0	0

*SWIMMER
**DEEP FORDING AS-IS

TABLE 16

CROSSING PERFORMANCE STATISTICS
WACROSS MID EAST AREA SOUTH-NORTH AXES

CORRIDOR WIDTH: 1.0 KM. AXIS LENGTH: 348.6 KM.

	PERCENT OF CROSSINGS GO			MEAN NO-GO PENALTY PER KILOMETER			MEAN KILOMETERS PER NO-GO CROSSING		
FLOW STAGE	HIGH	LOW	ALL	HIGH	LOW	ALL	HIGH	LOW	ALL
VEHICLES AS-IS									
M151A2	93	96	94	58	6	32	20.5	31.7	24.9
M861	79	81	80	71	28	49	6.7	7.1	6.9
*M561	96	98	97	43	3	23	34.9	69.7	46.5
M35A2	96	98	97	43	3	23	34.9	69.7	46.5
M813	92	94	93	48	9	28	18.3	23.2	20.5
*M656	96	98	97	42	3	23	38.7	69.7	49.8
*M520E1	96	98	97	42	3	23	38.7	69.7	49.8
M125E1	93	95	94	48	7	28	19.4	26.8	22.5
M818/M125	92	94	93	48	9	28	18.3	23.2	20.5
1D901	94	95	94	46	7	27	21.8	29.1	24.9
M548E1**	96	96	96	6	6	6	34.9	34.9	34.9
ALL	93	95	94	45	8	26	20.3	26.4	23.0
VEHICLES WITH DEEP FORDING									
M151A2	93	96	94	58	6	32	20.5	31.7	24.9
M861	79	81	80	71	28	49	6.7	7.1	6.9
*M561	96	98	97	43	3	23	34.9	69.7	46.5
M35A2	96	98	97	42	3	23	38.7	69.7	49.8
M813	93	94	93	48	9	28	19.4	23.2	21.1
*M656	96	98	97	42	3	23	38.7	69.7	49.8
*M520E1	97	98	98	38	3	21	49.8	69.7	58.1
M125E1	94	95	94	43	7	25	23.2	26.8	24.9
M818/M125	93	94	94	44	9	26	20.5	23.2	21.8
1D901	94	95	95	42	7	25	24.9	29.1	26.8
M548E1**	96	96	96	6	6	6	34.9	34.9	34.9
ALL	94	95	94	43	8	26	21.5	26.4	23.7
VEHICLES FOR REFERENCE									
*M113A2	97	97	97	5	5	5	43.6	43.6	43.6
*XM723	98	100	99	48	0	24	69.7		139.4
*M551	96	97	96	44	4	24	31.7	49.8	38.7
M60A1	97	99	98	41	1	21	49.8	174.3	77.5
ALL	97	98	98	34	2	18	45.0	82.0	58.1

*SWIMMER
**DEEP FORDING AS-IS

TABLE 17

CROSSING PERFORMANCE STATISTICS
WACROSS MID EAST AREA SOUTH-NORTH AXES

CORRIDOR WIDTH: 2.0 KM. AXIS LENGTH: 348.6 KM.

	PERCENT OF CROSSINGS GO			MEAN NO-GO PENALTY PER KILOMETER			MEAN KILOMETERS PER NO-GO CROSSING		
FLOW STAGE	HIGH	LOW	ALL	HIGH	LOW	ALL	HIGH	LOW	ALL
VEHICLES AS-IS									
M151A2	97	98	98	5	1	3	87.2	174.3	116.2
M861	84	89	87	13	8	10	15.8	24.9	19.4
*M561	99	100	100	1	0	0	348.6		697.2
M35A2	99	100	100	1	0	0	348.6		697.2
M813	93	96	95	5	3	4	38.7	69.7	49.8
*M656	99	100	100	1	0	0	348.6		697.2
*M520E1	99	100	100	1	0	0	348.6		697.2
M125E1	98	98	98	2	1	1	116.2	174.3	139.4
M818/M125	93	96	95	5	3	4	38.7	69.7	49.8
TD901	99	99	99	1	1	1	174.3	348.6	232.4
M548E1**	98	98	98	1	1	1	174.3	174.3	174.3
ALL	96	98	97	3	2	2	69.7	123.7	89.2
VEHICLES WITH DEEP FORDING									
M151A2	97	98	98	5	1	3	87.2	174.3	116.2
M861	84	89	87	13	8	10	15.8	24.9	19.4
*M561	99	100	100	1	0	0	348.6		697.2
M35A2	99	100	100	1	0	0	348.6		697.2
M813	93	96	95	5	3	4	38.7	69.7	49.8
*M656	99	100	100	1	0	0	348.6		697.2
*M520E1	100	100	100	0	0	0			
M125E1	98	98	98	1	1	1	174.3	174.3	174.3
M818/M125	95	96	96	3	3	3	58.1	69.7	63.4
TD901	99	99	99	1	1	1	348.6	348.6	348.6
M548E1**	98	98	98	1	1	1	174.3	174.3	174.3
ALL	97	98	97	3	2	2	78.3	123.7	95.9
VEHICLES FOR REFERENCE									
*M113A2	99	99	99	1	1	1	348.6	348.6	348.6
*XM723	98	100	99	4	0	2	174.3		348.6
*M551	99	99	99	1	1	1	348.6	348.6	348.6
M60A1	98	99	99	1	1	1	174.3	348.6	232.4
ALL	99	99	99	2	0	1	232.4	464.8	309.9

*SWIMMER
**DEEP FORDING AS-IS

TABLE 18

CROSSING PERFORMANCE STATISTICS
WACROSS MID EAST AREA SOUTH-NORTH AXES

CORRIDOR WIDTH: 4.0 KM. AXIS LENGTH: 348.6 KM.

	PERCENT OF CROSSINGS GO			MEAN NO-GO PENALTY PER KILOMETER			MEAN KILOMETERS PER NO-GO CROSSING		
FLOW STAGE	HIGH	LOW	ALL	HIGH	LOW	ALL	HIGH	LOW	ALL
VEHICLES AS-IS									
M151A2	100	100	100	0	0	0			
M861	93	97	95	3	1	2	69.7	174.3	99.6
*M561	100	100	100	0	0	0			
M35A2	100	100	100	0	0	0			
M813	97	97	97	1	1	1	174.3	174.3	174.3
*M656	100	100	100	0	0	0			
*M520E1	100	100	100	0	0	0			
M125E1	100	100	100	0	0	0			
M818/M125	97	97	97	1	1	1	174.3	174.3	174.3
TD901	100	100	100	0	0	0			
M548E1**	100	100	100	0	0	0			
ALL	99	99	99	0	0	0	426.1	639.1	511.3
VEHICLES WITH DEEP FORDING									
M151A2	100	100	100	0	0	0			
M861	93	97	95	3	1	2	69.7	174.3	99.6
*M561	100	100	100	0	0	0			
M35A2	100	100	100	0	0	0			
M813	97	97	97	1	1	1	174.3	174.3	174.3
*M656	100	100	100	0	0	0			
*M520E1	100	100	100	0	0	0			
M125E1	100	100	100	0	0	0			
M818/M125	97	97	97	1	1	1	174.3	174.3	174.3
TD901	100	100	100	0	0	0			
M548E1**	100	100	100	0	0	0			
ALL	99	99	99	0	0	0	426.1	639.1	511.3
VEHICLES FOR REFERENCE									
*M113A2	100	100	100	0	0	0			
*XM723	100	100	100	0	0	0			
*M551	100	100	100	0	0	0			
M60A1	100	100	100	0	0	0			
ALL	100	100	100	0	0	0			

*SWIMMER
**DEEP FORDING AS-IS

TABLE 19

RELATIVE LEVEL OF ASSISTANCE LEVELS REQUIRED
WACROSS MID-EAST AREA SOUTH-NORTH AXES

CORRIDOR WIDTH: 1.0 KM. AXIS LENGTH: 348.6 KM.
FLOW STAGE: ALL

ASSIST REQD	PERCENT NONE (GO)	D7 EGRS	FILL FORD	UET EGRS	RIBB S-R	MAB S-R	BAIL BRDG	RIBB B/R	MGB	MAB B/R	AVLB	NOGO
VEHICLES AS-IS												
M151A2	94	4	1	0	0	0	0	0	0	0	0	0
M861	80	18	1	0	0	0	0	0	0	0	0	0
*M561	97	2	1	0	0	0	0	0	0	0	0	0
M35A2	97	2	1	0	0	0	0	0	0	0	0	0
M813	93	6	1	0	0	0	0	0	0	0	0	0
*M656	97	2	1	0	0	0	0	0	0	0	0	0
*M520E1	97	2	1	0	0	0	0	0	0	0	0	0
M125E1	94	5	1	0	0	0	0	0	0	0	0	0
M818/M125	93	6	1	0	0	0	0	0	0	0	0	0
TD901	94	5	1	0	0	0	0	0	0	0	0	0
M548E1**	96	4	0	0	0	0	0	0	0	0	0	0
ALL	94	5	1	0	0	0	0	0	0	0	0	0
VEHICLES WITH DEEP FORDING												
M151A2	94	4	1	0	0	0	0	0	0	0	0	0
M861	80	18	1	0	0	0	0	0	0	0	0	0
*M561	97	2	1	0	0	0	0	0	0	0	0	0
M35A2	97	2	1	0	0	0	0	0	0	0	0	0
M813	93	6	1	0	0	0	0	0	0	0	0	0
*M656	97	2	1	0	0	0	0	0	0	0	0	0
*M520E1	98	2	0	0	0	0	0	0	0	0	0	0
M125E1	94	5	0	0	0	0	0	0	0	0	0	0
M818/M125	94	6	0	0	0	0	0	0	0	0	0	0
TD901	95	5	0	0	0	0	0	0	0	0	0	0
M548E1**	96	4	0	0	0	0	0	0	0	0	0	0
ALL	94	5	1	0	0	0	0	0	0	0	0	0
VEHICLES FOR REFERENCE												
*M113A2	97	3	0	0	0	0	0	0	0	0	0	0
*XM723	99	0	1	0	0	0	0	0	0	0	0	0
*M551	96	3	1	0	0	0	0	0	0	0	0	0
M60A1	98	1	1	0	0	0	0	0	0	0	0	0
ALL	98	2	1	0	0	0	0	0	0	0	0	0

*SWIMMER
**DEEP FORDING AS-IS

TABLE 20

RELATIVE LEVEL OF ASSISTANCE LEVELS REQUIRED
WACROSS MID-EAST AREA SOUTH-NORTH AXES

CORRIDOR WIDTH: 2.0 KM. AXIS LENGTH: 348.6 KM.
FLOW STAGE: ALL

ASSIST REQD	PERCENT NONE (GO)	D7 EGRS	FILL FORD	WET EGRS	RIBB S-R	MAB S-R	BAIL BRDG	RIBB B/R	MGB	MAB B/R	AVLB	NOGO
VEHICLES AS-IS												
M151A2	98	2	1	0	0	0	0	0	0	0	0	0
M861	87	13	0	0	0	0	0	0	0	0	0	0
*M561	100	0	0	0	0	0	0	0	0	0	0	0
M35A2	100	0	0	0	0	0	0	0	0	0	0	0
M813	95	5	0	0	0	0	0	0	0	0	0	0
*M656	100	0	0	0	0	0	0	0	0	0	0	0
*M520E1	100	0	0	0	0	0	0	0	0	0	0	0
M125E1	98	2	0	0	0	0	0	0	0	0	0	0
M818/M125	95	5	0	0	0	0	0	0	0	0	0	0
TD901	99	1	0	0	0	0	0	0	0	0	0	0
M548E1**	98	2	0	0	0	0	0	0	0	0	0	0
ALL	97	3	0	0	0	0	0	0	0	0	0	0
VEHICLES WITH DEEP FORDING												
M151A2	98	2	1	0	0	0	0	0	0	0	0	0
M861	87	13	0	0	0	0	0	0	0	0	0	0
*M561	100	0	0	0	0	0	0	0	0	0	0	0
M35A2	100	0	0	0	0	0	0	0	0	0	0	0
M813	95	5	0	0	0	0	0	0	0	0	0	0
*M656	100	0	0	0	0	0	0	0	0	0	0	0
*M520E1	100	0	0	0	0	0	0	0	0	0	0	0
M125E1	98	2	0	0	0	0	0	0	0	0	0	0
M818/M125	96	4	0	0	0	0	0	0	0	0	0	0
TD901	99	1	0	0	0	0	0	0	0	0	0	0
M548E1**	98	2	0	0	0	0	0	0	0	0	0	0
ALL	97	3	0	0	0	0	0	0	0	0	0	0
VEHICLES FOR REFERENCE												
*M113A2	99	1	0	0	0	0	0	0	0	0	0	0
*XM723	99	0	1	0	0	0	0	0	0	0	0	0
*M551	99	1	0	0	0	0	0	0	0	0	0	0
M60A1	99	1	0	0	0	0	0	0	0	0	0	0
ALL	99	1	0	0	0	0	0	0	0	0	0	0

*SWIMMER
**DEEP FORDING AS-IS

TABLE 21

RELATIVE LEVEL OF ASSISTANCE LEVELS REQUIRED
WACROSS MID EAST AREA SOUTH-NORTH AXES

CORRIDOR WIDTH: 4.0 KM. AXIS LENGTH: 348.6 KM.
FLOW STAGE: ALL

ASSIST REQD	PERCENT NONE (GO)	D7 EGRS	FILL FORD	WET EGRS	RIBB S-R	MAB S-R	BAIL BRDG	RIBB B/R	MGB	MAB B/R	AVLB	NOGO
					VEHICLES AS-IS							
M151A2	100	0	0	0	0	0	0	0	0	0	0	0
M861	95	5	0	0	0	0	0	0	0	0	0	0
*M561	100	0	0	0	0	0	0	0	0	0	0	0
M35A2	100	0	0	0	0	0	0	0	0	0	0	0
M813	97	3	0	0	0	0	0	0	0	0	0	0
*M656	100	0	0	0	0	0	0	0	0	0	0	0
*M520E1	100	0	0	0	0	0	0	0	0	0	0	0
M125E1	100	0	0	0	0	0	0	0	0	0	0	0
M818/M125	97	3	0	0	0	0	0	0	0	0	0	0
TD901	100	0	0	0	0	0	0	0	0	0	0	0
M548E1**	100	0	0	0	0	0	0	0	0	0	0	0
ALL	99	1	0	0	0	0	0	0	0	0	0	0
					VEHICLES WITH DEEP FORDING							
M151A2	100	0	0	0	0	0	0	0	0	0	0	0
M861	95	5	0	0	0	0	0	0	0	0	0	0
*M561	100	0	0	0	0	0	0	0	0	0	0	0
M35A2	100	0	0	0	0	0	0	0	0	0	0	0
M813	97	3	0	0	0	0	0	0	0	0	0	0
*M656	100	0	0	0	0	0	0	0	0	0	0	0
*M520E1	100	0	0	0	0	0	0	0	0	0	0	0
M125E1	100	0	0	0	0	0	0	0	0	0	0	0
M818/M125	97	3	0	0	0	0	0	0	0	0	0	0
TD901	100	0	0	0	0	0	0	0	0	0	0	0
M548E1**	100	0	0	0	0	0	0	0	0	0	0	0
ALL	99	1	0	0	0	0	0	0	0	0	0	0
					VEHICLES FOR REFERENCE							
*M113A2	100	0	0	0	0	0	0	0	0	0	0	0
*XM723	100	0	0	0	0	0	0	0	0	0	0	0
*M551	100	0	0	0	0	0	0	0	0	0	0	0
M60A1	100	0	0	0	0	0	0	0	0	0	0	0
ALL	100	0	0	0	0	0	0	0	0	0	0	0

*SWIMMER
**DEEP FORDING AS-IS

Table 22

Mean Distances Along Corridor Axes Between

Preferred Gap Crossing Sites

(Scenario Axes, All Stages)

Movement Corridor Width, km	West Germany Study Area, km	Mid-East Study Area, km
1	2.2	1.5
2	3.5	2.7
3	5.0	4.8

Table 23

Mean Distances Along Corridor Axes Between Crossings Requiring Assistance

(Scenario Axes, All Stages)

	West Germany Study Area		Mid-East Study Area	
Movement Corridor Width, km	All Study Wheeled Vehicles, km	All Study Tracked Vehicles, km	All Study Wheeled Vehicles, km	All Study Tracked Vehicles, km
1	2.4	5.2	22	58
2	3.7	8.7	87	310
4	5.5	16.2	340	349+

Table 24

Percent of Crossings GO - Mean for All Stages

(Scenario Axes)

Movement Corridor Width	West Germany Study Area — All Study Wheeled Vehicles	West Germany Study Area — All Study Tracked Vehicles	Mid-East Study Area — All Study Wheeled Vehicles	Mid-East Study Area — All Study Tracked Vehicles
5 m	1	40	90	95
1 km	1	54	94	97
2 km	1	58	97	99
4 km	1	67	99	100

APPENDIX A: TERRAIN DATA PREPARATION FOR WACROSS

1. Predictions of individual vehicle stream crossing performance at a given location at a given time (or water stage) using SWIMCRIT[2*] requires that the gap be described quantitatively at that time in terms of its cross-section dimensions, bank and bottom soils, gap-side vegetation (its cross-section factors), and water depth and velocity (its hydrologic factors), as shown in Table A1. Prediction of bridging times for various bridging or other gap modification options at a gap using the Bridging Capabilities Module (BCM) of the WES STAFGAP simulation[8] requires a reduced set of the same data needed for SWIMCRIT, as also indicated in Table A1. A continuous length along a gap throughout which distance values for each cross-section and hydrologic factor remain within the same class interval is considered nominally uniform. It is termed a <u>segment</u> and is assigned a <u>segment number</u>. The segment number references a <u>segment legend</u> containing the complete gap data that are taken to characterize the entire segment length. Such data were unavailable for the complete networks of gaps throughout the two WACROSS study areas.

2. In order to provide a reasonable set of study quality gap factor data for the two WACROSS study areas, a process was developed to assign the required gap factor values inferentially. This was done in each area by establishing for each site an analog to a measured site somewhere else in a similar climatic region based upon available incomplete data for the new site. For this purpose, basic data were drawn from appropriate topographic maps, some additional area-specific gap cross-section and hydrologic data, areal terrain data for the area, and quantitative descriptions of the gap-crossing sites for use as bases for estimating the characteristics of other sites by analogy.

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* Raised numbers refer to similarly numbered items in "References" on page 37 at end of the main test.

3. For the West Germany study area, measured gap data of the kind needed were available from a study of European waterways conducted by WES during 1969-1970.[3] The measured data describe 184 different crossing sites lying within a 70-km-wide east-west corridor across West Germany, roughly between the 49th and 50th parallels, and hence about 70 km south of the WACROSS study area (Figure 1). The 184 sites measured on the ground were subsequently expanded through air-photo analyses to 651 distinct sets of complete gap site factor data. These data are hereinafter referred to as the European Waterways Study (EWS) gap data. Gap factor values for sites within the WACROSS West Germany study area were assigned primarily by establishing analogs to an EWS gap on the basis of similarity in stream order, stream gradient, and areal terrain setting, despite the geographic shift.

4. For the WACROSS Mid-East study area, readily available data on the wadis and numerous small, intermittently wet gaps prevalent throughout most of the area were limited largely to a small number of spot measurements and ground photos made in the area in tangential connection with recent ad hoc WES vehicle test programs in broadly similar terrain further south. To form a basis for assigning gap-site factors throughout the Mid-East study area, these were augmented by gap measurements made in connection with the WES AMM validation test program conducted during 1970-1971 at Yuma, Ariz.[10]

5. Location of gaps for both study areas was taken from 1:50,000-scale topographic map sheets of the areas. All rivers, streams, canals, etc., or "blue-line" features, represented on the map were input to the computer in x-y digital coordinate form. Limited point data describing measured flows and/or cross-section data within the quad area were added where available. Finally, some approximate gap data were added to the x-y digitized feature maps of the West Germany study area from unclassified piloting maps for the navigable portion of the Fulda River.

6. Areal terrain data and stream orders for the two areas were drawn directly from the digitized study quality areal terrain maps and legends prepared by WES for these areas in 1974-1975 to support the TRADOC HIMO study.[7]

7. The analog gap data, gap-position data (with limited available gap factor data), and the areal terrain data were interacted to develop the final study gap data by the process outlined in the general flow chart shown in Figure A1 and in a somewhat more detailed chart in Figure A2. This process is briefly described in the following paragraphs. The description is keyed to the numbered <u>operations</u> shown in the flow charts as rectangles. Input data and outputs resulting from an operation are shown enclosed in oblong figures. In the more detailed flow chart (Figure A2) some of the more general, numbered operations indicated in Figure A1 are expanded to show some component operations. Such component operations carry the same number plus a letter. Because of the mass of data involved, the process, except for major portions of the basic data loading (Step 1), is entirely computerized.

8. The final product of the process is, first, a compressed computer array representing the gap map that locates and identifies by segment number all of the blue-line features on the original topographic map sheets. The line features are represented by a series of rectangular cells of selected size.* Each cell throughout the mapped area contains a number designating the segment numbers of all blue-line features that cross it <u>or</u> contains a zero to indicate that no blue-line features cross the cell. (For present use by the SWIMCRIT, BCM, and CORRIDOR and MADNET models described in paragraph 2, Appendix B, the number of features in a single cell was reduced to <u>one</u> at the final step. The segment number arbitrarily selected represented the segment having the greatest water width.)

9. The second final product of the process is a segment legend giving, for each segment number, the cross-section data developed (gap

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* For the WACROSS study, the cell size used was 127 m east-west by 105-5/6 m north-south. This is the same cell size adopted for areal terrain representation in the HIMO study.[7] It derives from convenience in using a standard computer line printer to make undistorted 1:25,000-scale data maps with two print characters available to display information concerning each cell.

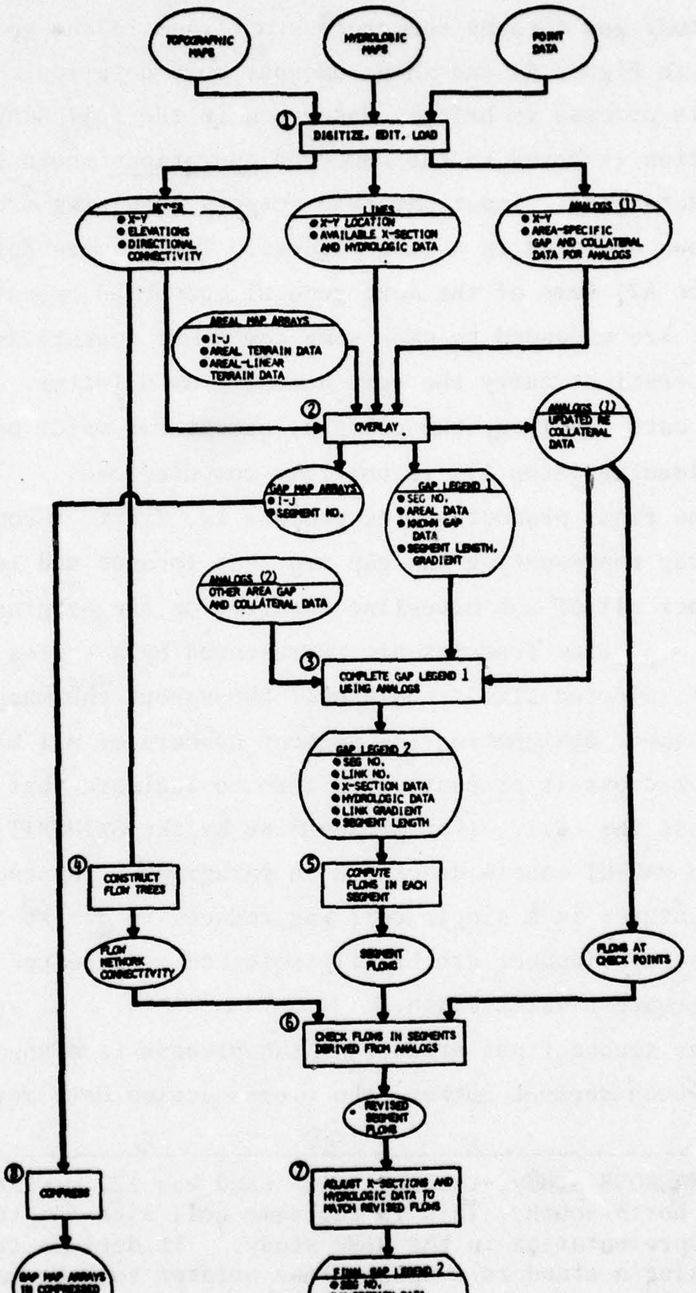


Figure A1. General flow chart

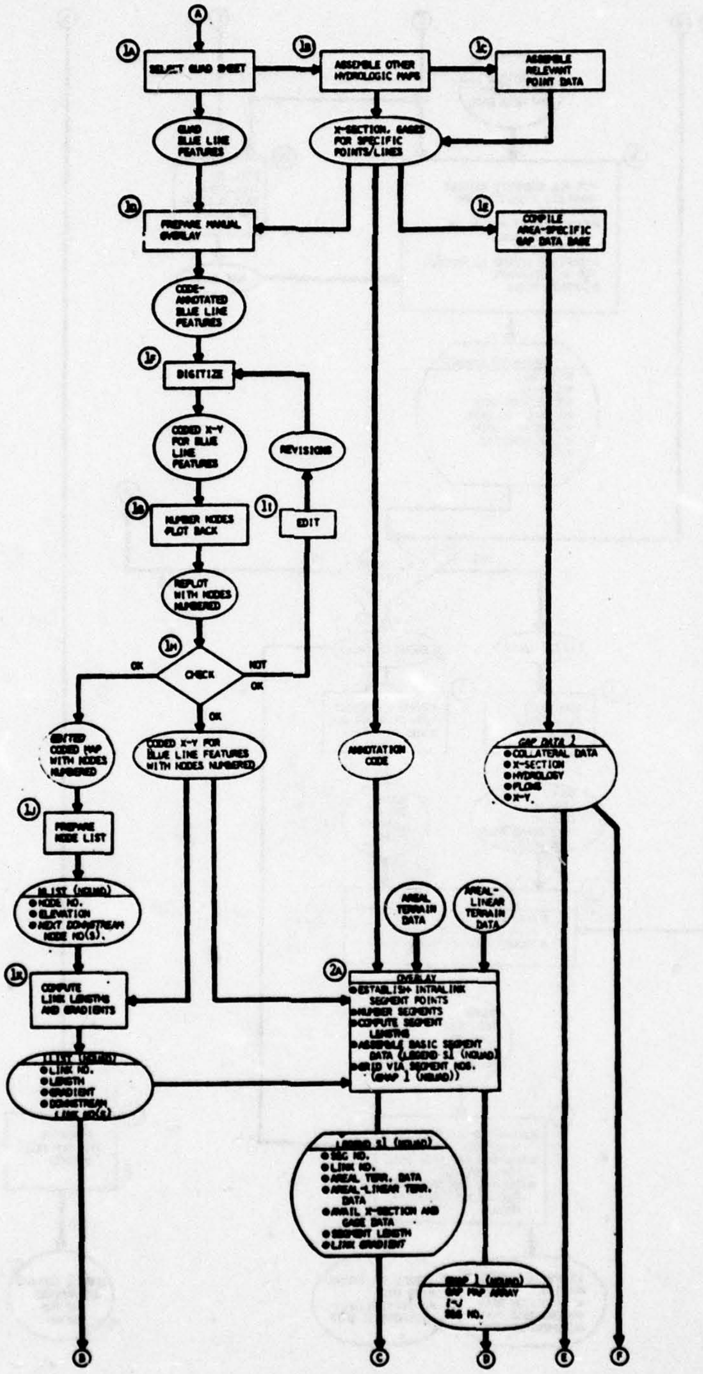


Figure A2. More detailed flow chart (sheet 1 of 2)

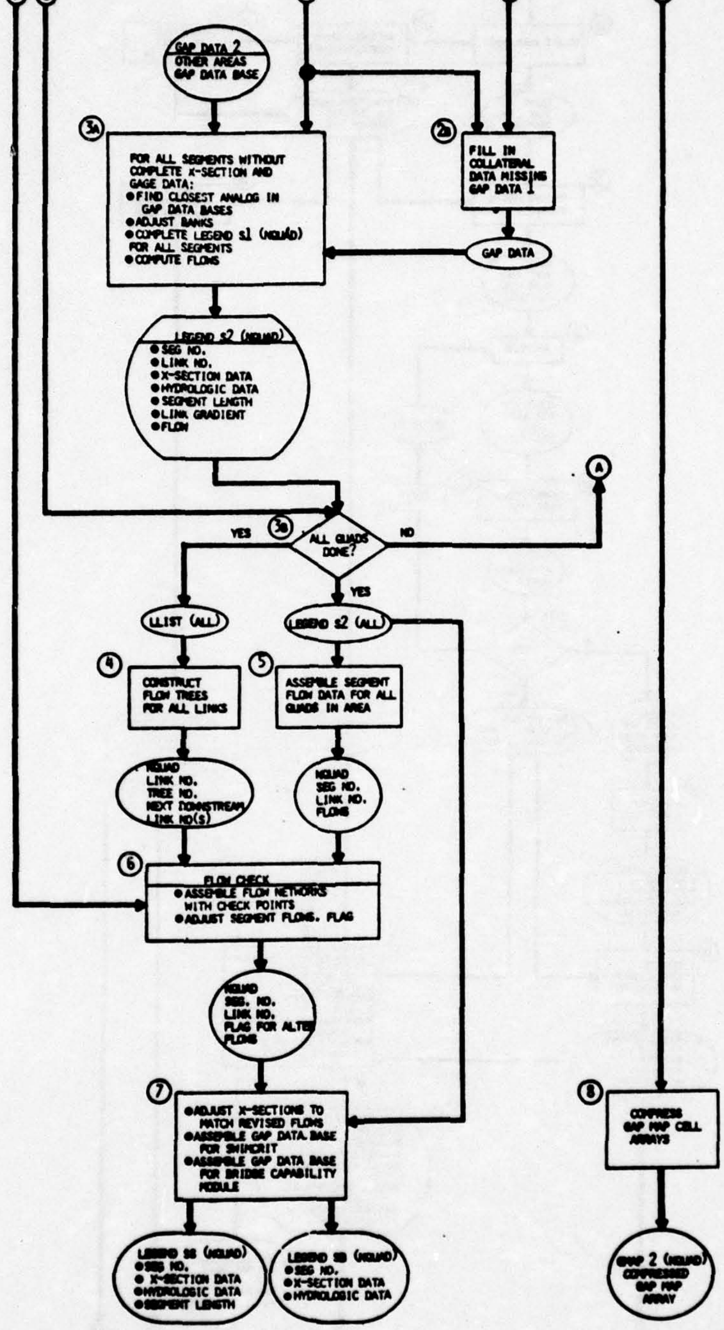


Figure A2 (sheet 2 of 2)

cross-section dimensions and angles, bank-soil strengths, and bank-vegetation parameters) and the hydrologic data developed (water depth and current velocity for three flow stages for the West Germany study area--high, average, and low; and two stages for the Mid-East area--high and low), plus the center-line length of the segment.

Step 1: Digitize, Edit, and Load area-specific data (except areal terrain data) for computer processing. This is performed on one topographic map sheet (quad) at a time (1A) until all quads of interest are processed through Step 3 (3B). Step 1 operations involve considerable manual work in the preparation of overlays showing blue-line features and available data (1D), entering these using a line-follower digitizer (1F), editing the results (1H, 1I), and preparing a list of all gap intersections (nodes) showing their elevations and downstream connectivity (1J). Once loaded, the computer determines distance along the gap center line between all connected nodes (or links) and the average gradient along each link (1K). The computer also begins, from the available information, the compilation of area-specific gap and collateral data for subsequent use as a basis for establishing analogs (1E).

Step 2: Overlay. Input data from Step 1 are overlaid in the computer on areal terrain data maps represented by cell arrays and legends that contain an areal terrain unit number for each cell and, in the legend, the associated areal terrain data: soil type; seasonal soil strength; slope; obstacle, roughness, vegetation and recognition distance data; plus the stream order of any drainage features that might be in the area (areal-linear data). At this stage, links are divided into segments at the points where they cross areal terrain unit boundaries; segments are numbered and their lengths computed; and the primary gap data base (Gap Legend 1) is established. It contains, for each numbered segment, segment center-line length, the link number of which the segment is a subset, the link gradient, the areal terrain data for cells through which the segment passes, the stream order, and any gap cross-section or hydrologic data available for the segment (2A). The computer also consults the areal terrain data to complete any collateral

data not originally input to the area-specific gap data list, that is, factors describing soils, vegetation, and slope of the areal setting (2B). When this is completed, the x-y coordinates of each link are converted to I-J cell representation and the segment number is stored in the appropriate I-J cell of the gap map cell array (2A).

Step 3: Complete Gap Legend 1 Using Analogs (derived from gap data for other areas as well as from those for the specific area). The computer searches the primary gap data base (Gap Legend 1) for all segments for which gap data are incomplete. For each such segment, it finds among all of the analog gap data available (area-specific and other-area) the closest analog based, in descending priority, on stream order, stream gradient, and local areal slope, soils, and vegetation. All characteristics of the selected analog site are stored as data for the segment, except that analog bank angles are rationally increased or decreased based upon differences in soil type and bank vegetation between the analog site and the segment. This search-and-fill operation is continued until data are completed for all segments. At this point, the output for each segment consists of complete cross-section and hydrologic data plus segment length, associated link number, and link gradient. In addition, based solely upon cross-section and hydrologic data, nominal flow rates for selected flow stages are computed for each segment (3A). Steps 1 through 3 are repeated for all quad sheets covering the area of interest (3B).

Step 4: Construct Flow Trees (using the link lists for all quads generated in Step 1 (1K)). At this point, each link is connected into one of the drainage "trees" within the area and identified with that tree.

Step 5: Assemble Segment Flow Data For All Quads in the Area (as computed in 3A).

Step 6: Check Flows in Segments Derived From Analogs. The data from Steps 4 and 5 are merged to check each drainage tree for flow anomalies at each selected stage, i.e., segments that pass too much or too little nominal flow at a given stage to balance network flows reasonably within the tree. Tree flows are controlled by hydrologic data

stored for check points in the area-specific (analog) gap data base. Segments that show flows substantially out of balance are each flagged, and a revised estimate for flow rate is returned.

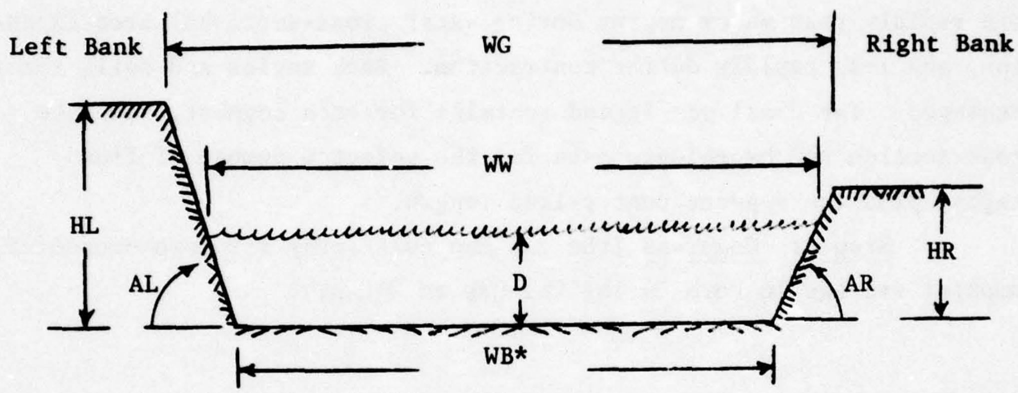
Step 7: Adjust Cross-Sections and Hydrologic Data to Match Revised Flows. Cross-section dimensions and stage current velocities of segments requiring flow adjustment are altered to produce the desired flow on the basis of the Manning numbers for the original and revised cross sections. In expanding or contracting cross-sectional areas, a simple, arbitrary algorithm was used to force gap widths to increase more rapidly than water depths during water cross-sectional area expansion, and less rapidly during contraction. Bank angles and soils remain unchanged. The final gap legend contains for each segment, complete cross-section and hydrologic data for the selected number of flow stages, plus the segment center-line length.

Step 8: Compress (the gap map cell array for more economical computer storage in core during its use in MADNET).

Table A1

Quantitative Characteristics of Gap-Crossing Sites

Used in SWIMCRIT and BCM Models



		Used in Model SWIMCRIT	BCM
CROSS-SECTION DIMENSIONS			
Gap width	WG	-	X
Water width	WW	X	X
Bottom Width	WB*	X	-
* If Depth (D) is > 1.4 m, WB is the distance between banks 1.4 m below the water line			
Bank Height, Left/Right	HL,HR	X	X
Bank Angle, Left/Right	AL,AR	X	X
CROSS-SECTION SOILS			
Soil Type and Cone Index		X	X
on Bank Tops, Left/Right		X	-
in Bank/Waterline zone, Left/Right		X	X
on Bottom			
HYDROLOGY (by water stages)			
Water Depth (D)		X	X
Associated Mean Current Speed		X	X

APPENDIX B: WACROSS COMPUTATION METHODOLOGY

1. To meet the objectives of the WACROSS study a computerized method was developed to examine the unassisted gap crossing performance of the study vehicles along corridors specified anywhere in the two study areas and to assess the degree of assistance required when an unassisted crossing was not possible. The method used two existing WES models, both of which require the gap data described in Table A1:

- a. SWIMCRIT, which predicts GO or NOGO for an unassisted gap crossing by a specific vehicle at a specific gap site and time (or water stage), and classes the reasons for failure when the situation is NOGO.[2*]
- b. BCM, the Bridging Capabilities Module of the WES STAFGAP simulation, which predicts placement time and personnel and equipment resources needed to provide gap crossing assistance of various kinds (AVLB, tactical bridging, ford or fill construction, etc.) at a given gap site and water stage.[8]

SWIMCRIT and BCM were used in tandem to develop vehicle-, site-, and stage-specific crossing scores (Appendix B, paragraph 4, Step 4) for all possible crossings in each study area.

2. Two closely related new computer programs, CORRIDOR and MADNET, were developed to examine the area-wide crossing data within the context of actual gap locations and of route selection options within any specified movement corridor:

- a. CORRIDOR prepares a vehicle-independent network, which is equivalent for analytical purposes to the gap-crossing situation within any specified movement corridor. CORRIDOR first extracts from the appropriate gap factor map a submap for a corridor defined by x-y coordinates of a center-line axis and by a corridor width that is taken to lie one-half to each side of the axis. The gap submap is then analyzed to identify and number all areal patches defined by gap lines and corridor boundaries. These are subsequently treated as nodes (termed "areal nodes") in constructing the equivalent network. Two areal nodes are

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* Raised numbers refer to similarly numbered items in "References" on page 37 at end of the main text.

considered to be connected if they have a common boundary. Each connected areal node pair is recorded together with a tabulation of all possible associated crossing paths (straight-line paths north-south and east-west only are considered). Each such path is defined by a list of all segment numbers (Appendix A, paragraph 1) encountered along it. Before outputting the final connected areal node pairs and associated possible crossing routes, routes between the two nodes that involve identical segments and routes, which are logically more severe than others (because they are identical except for additional crossings), are eliminated.

b. MADNET first converts a vehicle-independent network described by CORRIDOR to a vehicle-specific network by substituting, node pair-by-node pair, appropriate vehicle crossing scores (paragraphs 24 through 26) for all segments in each crossing route and saving only that route for which the total route crossing score is least. MADNET then uses the unambiguously defined network to find the path from one given areal node to another within the corridor that incurs the least total of the gap crossing scores. Finally, MADNET reconstructs the minimum score path and records the total number of crossings selected, the total path score, and the level of assistance required at each crossing (including none for an unassisted GO).

3. Computations are recorded on one quad sheet at a time. When all quad sheets for a study area are completely processed, the following two programs accumulate area-wide results and compute simple statistics and indices:

a. STATS I puts together the outputs of numerous MADNET results for different axes and corridor widths within an area and computes vehicle performance and assistance requirements indices related to specific operational axis directions, corridor widths, water stages, and vehicles. These indices reflect route selection to minimize levels of required assistance and quantify, through these levels, both the frequency and the severity of NOGO situations.

b. STATS II examines the unassisted vehicle crossing predictions for all gap segments described in the data base for an area, weighs the results for each segment according to its length in relation to total sample length (all segments), and computes Percent of Crossings GO, as well as Percent of Crossings GO when specific parts of the crossing sequence (such as ingress, swimming, or egress) only are considered. These indices, which reflect no

route or gap site selection, are directly comparable to those developed by WES in support of the 1975 CAA study.[2]

4. The complete, computerized methodology is outlined in the flow chart depicted in Figure B1. The brief descriptions of some of the methodology details that follow are keyed to the numbered operations shown in the flow chart as rectangles. (Input data and outputs resulting from an operation are enclosed in oblong figures.)

Step 1: As already noted, Steps 1 through 7 are performed on one quad sheet area at a time until all quads for a study area are processed.

Step 2: SWIMCRIT functions were briefly described in paragraph 1a of this appendix, and the model is discussed in more detail in Reference 2. SWIMCRIT requires, in addition to values for all gap factors at the water stage for which a prediction is required, the vehicle data shown in Appendix C. Most natural gap cross sections are assymetric. SWIMCRIT checks vehicle travel directly across each gap in both directions and records for each travel direction a series of GO/NOGO flags for the following sequence of crossing events: negotiation of vegetation on the approach bank; ingress from bank to water or gap bottom; crossing gap per se (swimming, fording, or traveling on the dry bottom, as appropriate); egress from the water or gap bottom up the departure bank; and negotiation of vegetation on the departure bank. All event flags must be GO for a crossing to be GO. As used as a part of the WACROSS methodology, however, only the water or gap bottom per se and the egress event flags are consulted. A water or gap bottom-crossing NOGO flag is used to signal a requirement for full-crossing assistance. An egress only NOGO flag is used to signal need for egress bank modification only. Moreover, in determining the GO/NOGO situation for further analysis the best case between the two directions of travel is used, i.e., a situation that is GO in one direction but NOGO in the other is considered GO; a situation requiring full-crossing assistance in one direction, but needing only egress bank modification in the other direction, is considered to need the egress assistance only. This somewhat arbitrary selection is intended to reflect, at least partially,

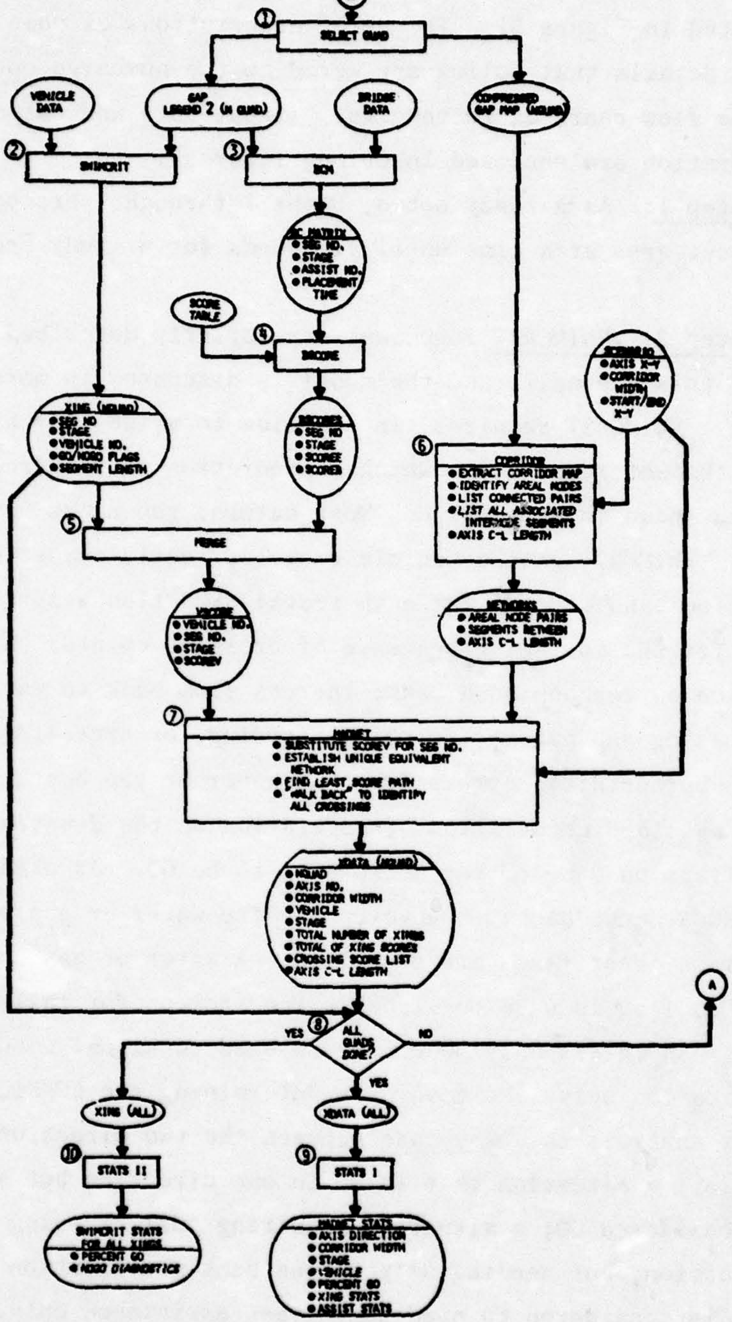

Figure B1. Computerized methodology flow chart

possibilities to cross many gaps by entering and exiting on banks that do not lie in a single plane cross section; that is, by using "windows," or stretches of only a few metres on one side or the other, having locally reduced bank heights and angles. Such windows are known to occur within nominally uniform segments of natural gaps but are well below the resolution of the study gap data. The output of SWIMCRIT for WACROSS study purposes is then, for each segment and selected water stage, a GO, NOGO, or egress-NOGO-only flag for each study vehicle. (Segment lengths are carried through from the gap data base to this output in order to facilitate compilation of statistics in Step 10.)

Step 3: BCM is the Bridging Capabilities Module of the WES STAFGAP simulation.[8] Its functions were briefly described in paragraph 1b of this appendix, and its details and bridging system data requirements are given in Reference 8. It was incorporated in the WACROSS methodology to provide times required to construct and/or emplace class 60 crossing assistance of the 16 types shown in Table 3. Computations for types 1 through 12 were available in the original STAFGAP version of BCM. Computations for types 13 through 16, which relate to potential methods for preparing egress banks only, were added specifically for WACROSS, based upon simple modifications to values computed for the first 12 methods. Several other possible egress assist options, such as a winch with on-board equipment, were not evaluated. Other extensive data computed in BCM--on personnel and equipment required--were not used, and neither resource inventories nor troop and equipment mobilization and travel times were considered (Step 4). The output of BCM for WACROSS study purposes is, for each segment and selected water stage, the placement time required (or a "not-possible" flag) for each of the 16 assistance options. The results are not vehicle dependent.

Step 4: BSCORE consults a SCORE table and the assist option times available from BCM. It selects for each gap configuration the priority option when full assistance is required and the priority option when only preparation of egress banks is required. The SCORE table per se (Table 3) assigns on the basis of military judgment of the vehicular missions involved two SCORES ranging from 200 to 9800 to each of the 16

possible assist options (paragraphs 24 through 27 of main text). Assist options that are not possible at a site are given a score of 9900. The first score in the SCORE table (SCORE 1) is associated with normal placement times for the option; the second, higher score (SCORE 2) is used when placement time exceeds the critical value also given in Table 3. In order to resolve selection priority conflicts in advance and to facilitate later classification of assist options selected during MADNET analyses, no two scores in the table are identical. BSCORE uses the SCORE table to select for the full assist case the option having the least score among the first 12 options, and the option having the least score among all 16 options for the egress bank preparation case. BSCORE outputs for each segment and selected water stage the two scores for the selected options associated with the two assistance types that might be required. At this point, the results are still not vehicle dependent but are in a general way scenario dependent as a result of inputs from the SCORE table.

Step 5: MERGE brings together segment-by-segment, stage-by-stage, and vehicle-by-vehicle the vehicle-dependent crossing GO/NOGO flags and the bridge- and scenario-dependent assistance selections. If for a given segment, stage, and vehicle the crossing is GO, a score of 100 is recorded for the segment-stage-vehicle combination. If the crossing is NOGO, the full-assist score from BSCORE is recorded. If the situation requires only egress bank modification, the egress-only score is recorded. The output of MERGE, which is now fully vehicle, bridge, and scenario dependent, is a single crossing score for each segment, water stage, and vehicle.

Step 6: CORRIDOR is described generally in paragraph 2a of this appendix. It uses only a corridor specification (axis coordinates and width) and the basic gap map that identifies, cell-by-cell, either a gap segment number or a null. It outputs the parameters of a network, which is analytically equivalent to the overall gap situation along the specified corridor, and is independent both of vehicles and of possible assist methods. (CORRIDOR also calculates for future use the distance along the axis center line from start point to end point. The distance

is, of course, independent of corridor width.)

Step 7: MADNET is described generally in paragraph 2b of this appendix. MADNET brings together the outputs from Steps 5 and 6 (along with route start and end points) to make and record the specific gap crossing predictions that are the basis for the final indices. It outputs for each axis, corridor width, water stage, and vehicle a complete list of all individual crossing scores along the path from start point to end point involving the least total score. Implicit in this list is the total number of crossings required and, because of the uniqueness of the crossing scores (Step 4), the number of times each assist option is called upon. (The axis center-line length, computed in CORRIDOR, is also included in the output to facilitate further processing.)

Step 8: STATS I collects the results from all MADNET runs for an area, once all quads are processed, and accumulates these in various ways to develop several indices. The following indices are computed, stratified by axis direction, corridor width, water stage, and vehicle:

a. Percent of Crossings GO, based on the total number of crossings selected.

b. Mean Penalty per NOGO Crossing, based again on selected crossings.

c. Mean Kilometers between NOGO Crossings, using axis center-line distance as the relevant distance, i.e., without considering possible path elongation due to zig-zag travel between selected crossing sites.

d. Mean Kilometers between Crossings (including both GO and NOGO crossings) again using axis center-line distance.

e. Mean Crossing Penalty per Kilometer, again using axis center-line distance. Note that this figure includes a penalty of 100 for each GO crossing.

f. Relative frequency of need for 12 types of crossing assistance as shown in Table 3.

Items a, b, and c provide the bases for the answers to the questions posed for the WACROSS study and are summarized in tables in the main text. Item d results proved to be almost totally insensitive to vehicle inputs. They may be considered diagnostic of the terrain itself, however, and were used in preparing Tables 4 and 5 of the main text.

Item e results were similar to, but less discriminating than, the item b indices and are therefore not presented; but they may (except when Percent of Crossings GO--item a--is 100) be estimated for any data set from corresponding a, b, and c values as follows:

$$\text{Item e} = \frac{1}{c} \cdot b + \frac{a}{1 - \frac{a}{100}}$$

Step 9: STATS II uses only the output of SWIMCRIT. It computes performance indices that conceptually address the unassisted gap crossing question with no considerations of gap-crossing site selection. Since MADNET implicitly assumes good gap reconnaisance, and SWIMCRIT assumes none, the index (Percent of Crossings GO) that is calculated in STATS II for all crossings and in STATS I for optimal crossings may be considered as probable bounds on actual operating values. Of course, when all crossings are NOGO, route selection does not improve matters so far as the index derived from MADNET data is concerned.

APPENDIX C: STUDY VEHICLE DATA BASE FOR SWIMCRIT MODEL

1. For purposes of making predictions of unassisted vehicle gap crossing GO/NOGO performance, a vehicle is described by a number of dimensions and performance parameters. Values used for these dimensions and parameters are given in Table C1 for the 10 representative study tactical support wheeled vehicles "as-is" (i.e., in their standard configuration) examined in the complete WACROSS computation methodology. Table C2 gives the values assigned to simulate the same vehicles with "deep-fording" capabilities. In converting the study vehicles from as-is to deep-fording configurations, allowable fording depth for each was made such that the vehicle driver's seat cushion was at the nominal fording waterline. Study vehicles that are swimmers as-is--the M561, M656, and M520E1--were assumed to be free-flooding throughout what are now their buoyant hulls.

2. Table C3 presents the vehicle values used for the tracked M548E1 tactical support vehicle and the four combat vehicles included in the study for reference purposes. The reference vehicles were studied only as-is, i.e., without nominal conversion to deep-fording, and the M548E1 with a 6-ton payload was considered to be a deep-forder as-is.

Table C1

Study Vehicle Characteristics for SWIMCRIT - Wheeled Vehicles As-Is

Vehicle*	Vehicle ID No.	Gross Vehicle Weight lb	VCI_1	Vehicle** Swim Speed mph	Vehicle Length in.	Vehicle Width in.	Minimum of Approach or Departure Angle degrees	Minimum Ground Clearance in.	Wheel Rolling Radius in.	Front to Rear Wheel Centerline Distance, in.	Direct Distance CG to Front Wheel Cl., in.	Distance Between Wheels with Greatest Span, in.	Direct Distance CG to Front Wheel Cl., in.	Fording Depth or Swimming Depth (From Ground), in.
M151A2, 1/4-ton, 4x4	1	3,200	19	0	133	64.0	37	9.0	13.4	85	44.8	85.0	11.6	20
M861, 1-1/4-ton, 4x4	2	7,000	33	0	210	79.5	13	7.8	14.8	131	83.0	131.0	15.3	30
M561, 1-1/4-ton, 6x6	3	9,172	19	2.0	230	84.0	52	15.8	18.7	166	91.5	84.8	16.0	39
M35A2, 2-1/2-ton, 6x6	4	19,300	30	0	278	96.0	40	19.1	17.7	178	90.8	130.0	22.3	30
M813, 5-ton, 6x6	5	32,540	35	0	317	101.0	35	11.5	18.7	206	123.5	152.0	30.6	30
M656, 5-ton, 8x8	6	23,835	20	2.5	276	96.0	50	20.0	20.4	206	111.0	90.0	15.3	68
M520E1, 8-ton, 4x4	7	43,210	36	0	375	108.0	35	29.0	31.7	235	112.0	235.0	13.1	60
M125E1, 10-ton, 6x6	8	51,630	42	0	320	114.0	30	26.0	22.7	200	133.5	139.5	50.0	30
M818, 6x6/ M127A1C	9	58,930	50	0	264	97.0	45	10.5	19.2	194	88.4	140.0	13.3	30
TDW, 8-ton, 8x8	10	37,992	24	0	310	96.0	52	34.0	20.4	166	111.0	108.0	32.0	45

* All wheeled vehicles.
** Use 0 for nonswimmer.

Table C2

Study Vehicle Characteristics for SWIMCRIT - Wheeled Vehicles Deep-Forder

Vehicle*	Vehicle ID No.	Gross Vehicle Weight lb	VCI_1	Vehicle Swim Speed** mph	Vehicle Length in.	Vehicle Width in.	Minimum of Approach or Departure Angle degrees	Minimum Ground Clearance in.	Wheel Rolling Radius in.	Front to Rear Wheel Centerline Distance in.	Direct Distance CG to Front Wheel Cl., in.	Distance Between Wheels with Greatest Span, in.	Vertical Distance CG to Front Wheel Cl, in.	Fording Depth or Swimming Depth (From Ground), in.
M151A2, 1/4-Ton, 4x4	12	3,200	19	0	133	64.0	37	9.0	13.4	85	44.8	85.0	11.6	60
M861, 1-1/4-Ton, 4x4	13	7,000	33	0	210	79.5	13	7.8	14.8	131	83.0	131.0	15.3	50
M561, 1-1/4-Ton, 6x6	14	9.172	19	0	230	84.0	52	15.8	18.7	166	91.5	84.8	16.0	46
M35A2, 2-1/2-Ton,6x6	15	19,300	30	0	278	96.0	40	19.1	17.7	178	90.8	130.0	22.3	72
M813, 5-Ton, 6x6	16	32,540	35	0	317	101.0	35	11.5	18.7	206	123.5	152.0	30.6	78
M656, 5-Ton, 8x8	17	23,835	20	0	276	96.0	50	20.0	20.4	206	111.0	90.0	15.3	76
M520E1, 8-ton, 4x4	18	43,210	36	0	375	108.0	35	29.0	31.7	235	112.0	235.0	13.1	82
M125E1, 10-Ton, 6x6	19	51,630	42	0	320	114.0	30	26.0	22.7	200	133.5	139.5	50.0	78
M818, 6x6/M127A1C	20	58,930	50	0	264	97.0	45	10.5	19.2	194	88.4	140.0	13.3	78
TDW, 8-Ton, 8x8	21	37,992	24	0	310	96.0	52	34.0	20.4	166	111.0	108.0	32.0	75

* All wheeled vehicles.
** Use 0 for nonswimmer.

Table C3

Study Vehicle Characteristics for SWIMCRIT - Tracked Vehicles

Vehicle	Vehicle ID No.	Gross Vehicle Weight lb	VCI_1	Vehicle Swim Speed mph	Vehicle Length in.	Vehicle Width in.	Minimum of Approach or Departure Angle degrees	Minimum Ground Clearance in.	Roadwheel Radius Track Thickness in.	Distance Between First and Last Road-Wheel, in.	Direct Distance from CG to Rear Roadwheel in.	Vertical Distance From Knuckle To Minimum Clearance Line, in.	Vertical Distance From CG to Ground in.	Sand Performance Numeric	Sprocket/ Idler Radius in.	Horizontal Distance From Rear Roadwheel to Rear Sprocket/ Idler, in.	Vertical Distance From Rear Roadwheel To Rear Sprocket/ Idler, in.	Fording Depth or Swimming Depth (From Ground), in.
M548E1, 6-Ton Carrier*	11	26,450	16	0	226	106	35	16	14.0	111	58.5	8	35.5	0.97	10.0	30.0	6	76
REFERENCE VEHICLES**																		
M113A1	23	23,380	16	3.6	192	106	40	16	14.8	105	58.6	18	38.8	0.89	10.5	24.7	4	62
XM723	24	40,350	12	5.3	265	126	78	18	14.8	150	106.4	22	43.6	1.51	10.5	28.6	13	67
M551	25	35,860	15	3.1	248	110	38	18	16.8	140	99.7	24	43.8	1.12	8.4	32.8	11	56
M60	26	104,000	21	0	273	143	42	18	17.0	167	124.0	30	50.0	1.06	12.2	47.0	25	48

* Deep-forder as-is
** All as-is

APPENDIX D: GAP FACTOR DISTRIBUTIONS FOR THE STUDY AREAS

Table D1 shows for all gaps described in the West Germany study area gap data base the relative occurrence at three water stages of water depths and water widths and their joint occurrences. Table D2 presents the relative occurrence in the area of bank heights and bank angles for the same three stages. Tables D3 and D4 give corresponding figures for the Mid-East study area at two water stages.

Table D1

Gap Size - West Germany Study Area

Gap Width, m	Gap Depth, m 0<0.6	0.6<0.9	0.9<1.2	1.2<1.5	1.5<2.0	2.0<2.5	2.5<3.5	3.5<5.0	>5.0	All
High Stage										
0<0.9	3.8	18.4	10.8	11.2	0.2	0.0	0.0	0.0	0.0	44.3
0.9<1.8	3.7	0.4	0.6	6.1	5.6	0.0	0.0	0.0	0.0	16.5
1.8<2.7	3.6	1.1	0.2	0.3	2.7	0.8	0.0	0.0	0.0	8.7
2.7<3.7	5.2	1.9	0.4	0.2	0.5	0.5	0.0	0.1	0.0	8.8
3.7<4.6	0.3	3.3	0.3	0.4	0.3	0.2	0.4	0.0	0.0	5.4
4.6<6.1	0.0	3.4	0.2	0.2	0.1	0.2	0.1	0.0	0.0	4.2
6.1<7.6	0.0	0.8	0.7	0.1	0.9	0.3	0.1	0.1	0.0	3.0
7.6<9.0	0.0	0.1	0.8	0.0	0.5	0.2	0.1	0.0	0.0	1.8
≥9.0	0.0	0.0	0.9	0.9	1.1	1.8	1.6	1.0	0.0	7.3
All	16.7	29.4	14.9	19.5	12.1	4.0	2.4	1.2	0.0	100.0
Average Stage										
0<0.9	33.4	12.5	0.3	0.1	0.0	0.0	0.0	0.0	0.0	46.2
0.9<1.8	4.6	10.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	15.6
1.8<2.7	5.1	0.6	2.4	0.2	0.0	0.0	0.0	0.0	0.0	8.3
2.7<3.7	7.6	0.3	0.2	0.3	0.3	0.0	0.0	0.0	0.0	8.7
3.7<4.6	4.2	0.2	0.0	0.1	0.5	0.0	0.0	0.0	0.0	5.0
4.6<6.1	3.8	0.4	0.1	0.0	0.1	0.1	0.0	0.0	0.0	4.5
6.1<7.6	1.7	1.1	0.2	0.1	0.0	0.1	0.0	0.0	0.0	3.1
7.6<9.0	0.8	0.6	0.2	0.0	0.0	0.0	0.0	0.0	0.0	1.7
≥9.0	1.8	1.8	2.2	0.3	0.6	0.0	0.2	0.0	0.0	6.9
All	63.0	27.4	6.7	1.1	1.5	0.2	0.2	0.0	0.0	100.0
Low Stage										
0<0.9	46.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	46.2
0.9<1.8	15.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.6
1.8<2.7	8.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.3
2.7<3.7	8.6	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.8
3.7<4.6	4.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0
4.6<6.1	4.3	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	4.5
6.1<7.6	2.9	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0
7.6<9.0	1.6	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	1.8
≥9.0	6.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.7
All	98.0	1.7	0.3	0.0	0.0	0.0	0.0	0.0	0.0	100.0

Table D2

Gap Banks - West Germany Study Area

Bank Angle, m	Bank Height, m										
	0<0.3	0.3<0.6	0.6<0.9	0.9<1.2	1.2<1.5	1.5<2.0	2.0<2.4	2.4<3.4	3.4<6.1	>6.1	All
High Stage											
0<10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10<15	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1
15<20	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	1.0	0.0	1.3
20<30	0.0	0.0	1.1	0.1	0.1	0.1	1.7	3.2	0.8	0.0	7.3
30<40	0.0	0.0	2.4	0.3	0.2	5.8	2.7	0.1	2.0	0.0	12.9
40<60	0.0	0.0	4.2	0.5	0.3	4.1	2.3	4.7	1.3	0.0	17.4
60<80	0.0	0.0	8.2	7.0	1.0	15.4	14.5	11.8	3.0	0.0	61.0
≥80	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	0.0	0.0	15.9	7.9	1.7	25.7	20.7	19.9	8.1	0.0	100.0
Average Stage											
0<10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10<15	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1
15<20	0.0	0.0	0.0	0.0	0.1	0.3	0.1	0.3	0.5	0.0	1.3
20<30	0.0	0.0	0.8	0.6	0.3	0.5	1.8	3.1	0.2	0.0	7.3
30<40	0.0	1.1	1.4	0.2	3.6	3.1	1.8	0.3	1.4	0.0	12.9
40<60	0.0	0.0	4.2	0.5	0.2	6.7	2.6	1.4	1.6	0.0	17.4
60<80	0.0	0.1	10.5	4.2	10.4	12.6	12.6	6.8	3.7	0.0	61.0
≥80	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	0.0	1.2	16.9	5.5	14.7	23.2	18.9	11.9	7.5	0.0	100.0
Low Stage											
0<10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10<15	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1
15<20	1.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	1.3
20<30	2.3	0.0	0.0	0.0	0.1	4.6	0.3	0.0	0.0	0.0	7.3
30<40	7.3	0.0	0.0	0.1	3.5	0.6	0.3	0.5	0.5	0.0	12.9
40<60	5.9	1.1	2.8	0.8	3.0	2.8	0.6	0.2	0.2	0.0	17.4
60<80	33.4	0.1	6.1	1.1	7.3	8.1	1.6	1.1	2.2	0.0	61.0
≥80	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	50.0	1.2	8.9	2.0	13.9	16.3	2.8	1.9	2.9	0.0	100.0

Table D3

Gap Size - Mid-East Study Area

Gap Width, m	Gap Depth, m 0<0.6	0.6<0.9	0.9<1.2	1.2<1.5	1.5<2.0	2.0<2.5	2.5<3.5	3.5<5.0	>5.0	All
High Stage										
0<0.9	71.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	71.1
0.9<1.8	14.5	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.3
1.8<2.7	0.0	0.0	2.4	0.0	0.0	0.0	0.0	0.0	0.0	2.4
2.7<3.7	2.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.3
3.7<4.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4.6<6.1	0.6	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1
6.1<7.6	0.0	0.3	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.9
7.6<9.1	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.2
≥9.1	2.7	0.4	0.1	1.9	0.5	0.0	0.0	0.0	0.0	5.6
All	91.2	3.0	2.8	2.6	0.5	0.0	0.0	0.0	0.0	100.0
Low Stage										
0<0.9	71.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	71.1
0.9<1.8	16.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.3
1.8<2.7	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4
2.7<3.7	4.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.7
3.7<4.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4.6<6.1	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1
6.1<7.6	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
7.6<9.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
≥9.1	3.8	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.9
All	99.9	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0

Table D4

Gap Banks - Mid-East Study Area

Bank Angle, m	Bank Height, m										
	0<0.3	0.3<0.6	0.6<0.9	0.9<1.2	1.2<1.5	1.5<2.0	2.0<2.4	2.4<3.4	3.4<6.1	>6.1	All
High Stage											
0<10	71.9	12.3	2.5	3.8	1.2	0.0	0.0	0.0	0.0	0.0	91.7
10<15	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.2
15<20	0.0	0.0	0.0	0.2	0.0	0.2	0.0	0.0	0.0	0.0	0.4
20<30	2.0	0.4	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	2.9
30<40	3.9	0.7	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	4.8
40<60	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
60<80	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
≥80	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	77.7	13.4	3.0	4.3	1.3	0.2	0.0	0.0	0.0	0.0	100.0
Low Stage											
0<10	81.8	6.2	1.2	1.3	1.2	0.0	0.0	0.0	0.0	0.0	91.7
10<15	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.2
15<20	0.2	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.4
20<30	2.4	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.9
30<40	4.3	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.8
40<60	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
60<80	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
≥80	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	88.9	6.7	1.5	1.4	1.3	0.2	0.0	0.0	0.0	0.0	100.0

APPENDIX E: DATA SHOWING CORRIDOR DIRECTION AND WATER STAGE EFFECTS ON RESULTS, WEST GERMANY STUDY AREA

1. Tables 10 through 12 of the main text present MOE values derived from all 14 of the scenario-oriented axes in the West Germany study area, both those running generally east-west and those running generally north-south, each at three corridor widths. Tables E1 through E3 present the same data for the seven east-west trending axes only; Tables E7 through E9 present the data for the seven north-south axes.

2. Tables 13 through 15 of the main text present breakdowns of assistance methods called upon for all axes and all three water stages for each of three corridor widths. Tables E4 through E6 give the same information for the east-west corridors only; Tables E10 through E12 give the information for the north-south corridors. In addition, Tables E13 through E33 present the data for individual water stages, by axis direction, corridor width, and flow stage. Finally, Tables E34 through E39 present the same data for all axes, again by corridor width and flow stage.

TABLE E1

CROSSING PERFORMANCE STATISTICS
WACROSS WEST GERMANY EAST-WEST AXES

CORRIDOR WIDTH: 1.0 KM. AXIS LENGTH: 208.1 KM.

	PERCENT OF CROSSINGS GO				MEAN NO-GO PENALTY PER KILOMETER				MEAN KILOMETERS PER NO-GO CROSSING			
FLOW STAGE	HIGH	AVER	LOW	ALL	HIGH	AVER	LOW	ALL	HIGH	AVER	LOW	ALL
VEHICLES AS-IS												
M151A2	0	0	0	0	173	130	95	133	2.3	2.5	2.4	2.4
M861	0	0	0	0	169	128	95	131	2.3	2.5	2.4	2.4
*M561	0	0	0	0	151	116	95	121	2.4	2.5	2.4	2.4
M35A2	0	0	1	0	160	128	94	127	2.3	2.5	2.5	2.4
M813	0	0	0	0	160	128	95	128	2.3	2.5	2.4	2.4
*M656	0	1	3	2	147	114	91	117	2.4	2.5	2.5	2.5
*M520E1	10	10	7	9	139	108	88	111	2.6	2.8	2.6	2.7
M125E1	0	0	0	0	160	128	95	128	2.3	2.5	2.4	2.4
M818/M125	0	0	0	0	160	128	95	128	2.3	2.5	2.4	2.4
TD901	1	1	6	3	146	114	88	116	2.4	2.5	2.6	2.5
M548E1**	41	36	40	39	50	84	61	65	4.0	3.7	4.0	3.9
ALL	5	5	5	5	147	119	90	119	2.4	2.6	2.6	2.5
VEHICLES WITH DEEP FORDING												
M151A2	0	0	0	0	173	130	95	133	2.3	2.5	2.4	2.4
M861	0	0	0	0	169	128	95	131	2.3	2.5	2.4	2.4
*M561	0	0	0	0	155	116	95	122	2.4	2.5	2.4	2.4
M35A2	0	0	1	0	151	115	93	120	2.3	2.5	2.4	2.4
M813	0	0	0	0	151	115	94	120	2.3	2.5	2.4	2.4
*M656	0	1	3	2	148	114	91	118	2.4	2.5	2.5	2.5
*M520E1	10	10	7	9	136	108	88	111	2.6	2.8	2.6	2.7
M125E1	0	0	0	0	139	115	94	116	2.3	2.5	2.4	2.4
M818/M125	0	0	0	0	148	115	94	119	2.4	2.5	2.4	2.4
TD901	1	1	6	3	126	114	88	109	2.4	2.5	2.6	2.5
M548E1**	41	36	40	39	50	84	61	65	4.0	3.7	4.0	3.9
ALL	5	5	5	5	141	114	90	115	2.5	2.6	2.6	2.5
VEHICLES FOR REFERENCE												
*M113A2	38	36	42	39	60	84	59	68	3.8	3.7	4.2	3.9
*XM723	67	70	74	70	35	57	32	41	7.2	8.3	9.5	8.2
*M551	55	52	58	55	45	74	47	55	5.3	4.7	5.6	5.2
M60A1	59	62	66	63	43	64	39	49	5.9	6.5	7.2	6.5
ALL	55	55	60	57	46	70	44	53	5.3	5.3	6.0	5.5

*SWIMMER
**DEEP FORDING AS-IS

TABLE E2

CROSSING PERFORMANCE STATISTICS
WACROSS WEST GERMANY EAST-WEST AXES

CORRIDOR WIDTH: 2.0 KM. AXIS LENGTH: 208.1 KM.

FLOW STAGE	PERCENT OF CROSSINGS GO HIGH	AVER	LOW	ALL	MEAN NO-GO PENALTY PER KILOMETER HIGH	AVER	LOW	ALL	MEAN KILOMETERS PER NO-GO CROSSING HIGH	AVER	LOW	ALL
VEHICLES AS-IS												
M151A2	0	0	0	0	116	89	53	86	3.3	3.9	3.8	3.7
M861	0	0	0	0	110	89	53	84	3.5	3.9	3.8	3.7
*M561	0	0	0	0	102	87	53	81	3.5	3.9	3.8	3.7
M35A2	0	0	0	0	104	89	53	82	3.5	3.9	3.8	3.7
M813	0	0	0	0	104	89	53	82	3.5	3.9	3.8	3.7
*M656	0	2	4	2	98	57	50	68	3.6	3.9	4.0	3.8
*M520E1	5	5	0	4	98	55	52	68	3.8	4.0	3.9	3.9
M125E1	0	0	0	0	104	89	53	82	3.5	3.9	3.8	3.7
M818/M125	0	0	0	0	104	89	53	82	3.5	3.9	3.8	3.7
1D901	0	0	8	2	98	58	47	68	3.6	3.8	4.2	3.9
M548E1**	40	36	39	38	34	38	32	35	5.9	5.5	6.3	5.9
ALL	4	4	5	4	97	76	50	74	3.7	4.0	4.0	3.9
VEHICLES WITH DEEP FORDING												
M151A2	0	0	0	0	116	89	53	86	3.3	3.9	3.8	3.7
M861	0	0	0	0	110	89	53	84	3.5	3.9	3.8	3.7
*M561	0	0	0	0	104	87	53	81	3.5	3.9	3.8	3.7
M35A2	0	0	0	0	103	58	52	71	3.6	3.8	3.9	3.7
M813	0	0	0	0	100	58	52	70	3.6	3.8	3.9	3.7
*M656	0	2	4	2	98	57	50	68	3.6	3.9	4.0	3.8
*M520E1	5	5	0	4	95	55	52	67	3.8	4.0	3.9	3.9
M125E1	0	0	0	0	96	58	52	68	3.7	3.8	3.9	3.8
M818/M125	0	0	0	0	98	58	52	69	3.6	3.8	3.9	3.7
1D901	0	0	8	2	91	58	47	65	3.6	3.8	4.2	3.9
M548E1**	40	36	39	38	34	38	32	35	5.9	5.5	6.3	5.9
ALL	4	4	5	4	95	64	50	70	3.7	4.0	4.0	3.9
VEHICLES FOR REFERENCE												
*M113A2	37	36	41	38	37	38	31	35	5.5	5.5	6.5	5.8
*XM723	72	75	77	75	16	18	12	16	12.2	14.9	16.0	14.2
*M551	66	57	63	62	21	29	21	24	9.9	7.4	9.5	8.8
M60A1	69	71	75	72	19	21	13	18	11.0	12.2	14.9	12.5
ALL	61	59	64	62	23	27	19	23	8.8	8.6	10.3	9.1

*SWIMMER
**DEEP FORDING AS-IS

AD-A065 409 ARMY ENGINEER WATERWAYS EXPERIMENT STATION VICKSBURG MISS F/G 13/2
AN ASSESSMENT OF THE INLAND WATER CROSSING PERFORMANCE OF SELEC--ETC(U)
JAN 79 C J NUTTALL
UNCLASSIFIED WES-TR-GL-79-1 NL

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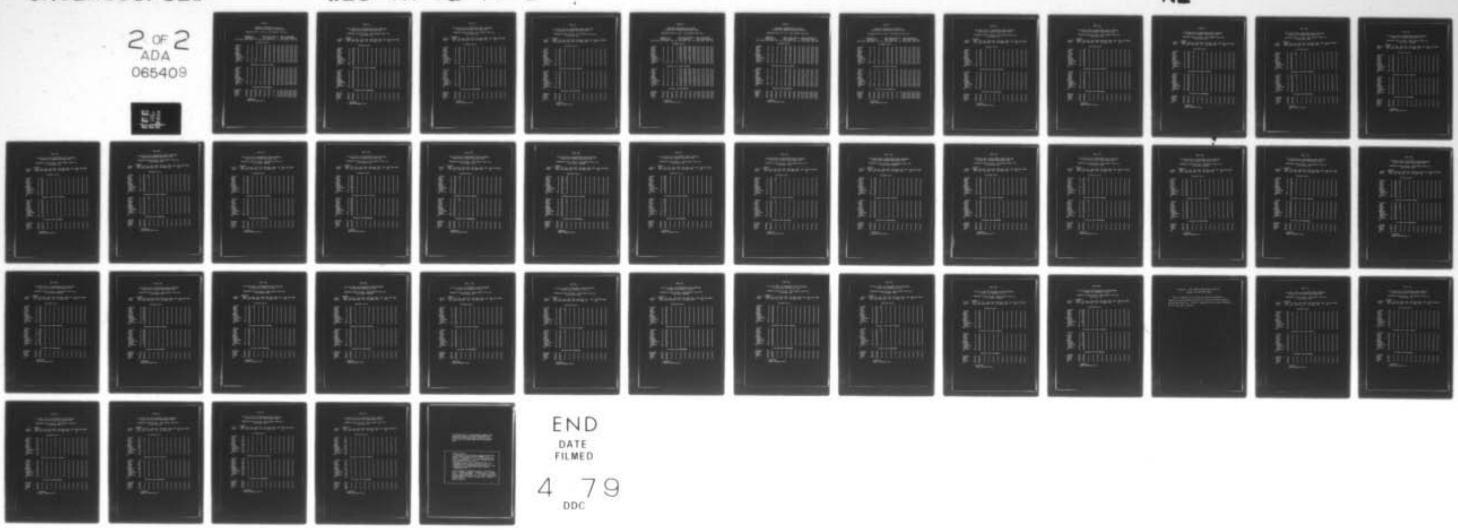

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TABLE E3

CROSSING PERFORMANCE STATISTICS
WACROSS WEST GERMANY EAST-WEST AXES

CORRIDOR WIDTH: 4.0 KM. AXIS LENGTH: 208.1 KM.

FLOW STAGE	PERCENT OF CROSSINGS GO HIGH	AVER	LOW	ALL	MEAN NO-GO PENALTY PER KILOMETER HIGH	AVER	LOW	ALL	MEAN KILOMETERS PER NO-GO CROSSING HIGH	AVER	LOW	ALL
VEHICLES AS-IS												
M151A2	0	0	0	0	93	74	39	69	4.6	5.3	5.1	5.0
M861	0	0	0	0	88	74	39	67	4.7	5.3	5.1	5.0
*M561	0	0	0	0	84	73	39	65	4.8	5.5	5.1	5.1
M35A2	0	0	2	1	84	74	38	66	4.8	5.3	5.2	5.1
M813	0	0	0	0	84	74	39	66	4.8	5.3	5.1	5.1
*M656	0	2	3	2	81	43	37	54	5.0	5.2	5.3	5.2
*M520E1	0	2	3	2	83	43	37	55	5.0	5.2	5.3	5.2
M125E1	0	0	0	0	84	74	39	66	4.8	5.3	5.1	5.1
M818/M125	0	0	0	0	84	74	39	66	4.8	5.3	5.1	5.1
TD901	0	0	13	4	81	44	33	53	5.0	5.1	6.1	5.3
M548E1**	52	51	61	55	20	23	15	20	9.9	9.5	13.0	10.6
ALL	5	6	7	6	79	61	36	59	5.1	5.5	5.5	5.4
VEHICLES WITH DEEP FORDING												
M151A2	0	0	0	0	93	74	39	69	4.6	5.3	5.1	5.0
M861	0	0	0	0	88	74	39	67	4.7	5.3	5.1	5.0
*M561	0	0	0	0	84	73	39	65	4.8	5.5	5.1	5.1
M35A2	0	2	3	2	84	43	37	55	4.8	5.2	5.3	5.1
M813	0	0	0	0	83	44	38	55	5.0	5.1	5.2	5.1
*M656	0	2	3	2	81	43	37	54	5.0	5.2	5.3	5.2
*M520E1	0	2	3	2	81	43	37	54	5.0	5.2	5.3	5.2
M125E1	0	0	0	0	77	44	38	53	5.0	5.1	5.2	5.1
M818/M125	0	0	0	0	77	44	38	53	5.0	5.1	5.2	5.1
TD901	0	0	13	4	74	44	33	50	5.0	5.1	6.1	5.3
M548E1**	52	51	61	55	20	23	15	20	9.9	9.5	13.0	10.6
ALL	5	6	7	6	77	50	36	54	5.1	5.4	5.6	5.4
VEHICLES FOR REFERENCE												
*M113A2	48	48	63	53	23	25	14	21	8.7	8.7	13.9	9.9
*XM723	80	83	85	82	9	12	6	9	23.1	29.7	34.7	28.4
*M551	65	65	80	70	14	18	9	14	13.9	12.2	23.1	15.2
M60A1	67	73	82	74	13	15	7	12	14.9	18.9	29.7	19.5
ALL	65	66	77	69	15	18	9	14	13.4	14.1	22.5	15.8

*SWIMMER
**DEEP FORDING AS-IS

TABLE E4

RELATIVE LEVEL OF ASSISTANCE LEVELS REQUIRED
WACROSS WEST GERMANY EAST-WEST AXES

CORRIDOR WIDTH: 1.0 KM. AXIS LENGTH: 208.1 KM.
FLOW STAGE: ALL

ASSIST REQD	PERCENT NONE (GO)	D7 EGRS	FILL FORD	UE EGRS	RIBB S-R	MAB S-R	BAIL BRDG	RIBB B/R	MGB	MAB B/R	AVLB	NOGO
					VEHICLES AS-IS							
M151A2	0	88	10	0	0	0	2	0	0	0	0	0
M861	0	90	8	0	0	0	2	0	0	0	0	0
*M561	0	95	4	0	0	0	2	0	0	0	0	0
M35A2	0	93	5	0	0	0	2	0	0	0	0	0
M813	0	93	5	0	0	0	2	0	0	0	0	0
*M656	2	95	2	0	0	0	2	0	0	0	0	0
*M520E1	9	87	2	0	0	0	2	0	0	0	0	0
M125E1	0	93	5	0	0	0	2	0	0	0	0	0
M818/M125	0	93	5	0	0	0	2	0	0	0	0	0
TD901	3	93	2	0	0	0	2	0	0	0	0	0
M548E1**	39	60	1	0	0	0	0	0	0	0	0	0
ALL	5	89	4	0	0	0	2	0	0	0	0	0
					VEHICLES WITH DEEP FORDING							
M151A2	0	88	10	0	0	0	2	0	0	0	0	0
M861	0	90	8	0	0	0	2	0	0	0	0	0
*M561	0	94	4	0	0	0	2	0	0	0	0	0
M35A2	0	95	2	0	0	0	2	0	0	0	0	0
M813	0	96	2	0	0	0	2	0	0	0	0	0
*M656	2	95	2	0	0	0	2	0	0	0	0	0
*M520E1	9	88	2	0	0	0	2	0	0	0	0	0
M125E1	0	97	2	0	0	0	2	0	0	0	0	0
M818/M125	0	96	2	0	0	0	2	0	0	0	0	0
TD901	3	95	2	0	0	0	1	0	0	0	0	0
M548E1**	39	60	1	0	0	0	0	0	0	0	0	0
ALL	5	90	3	0	0	0	2	0	0	0	0	0
					VEHICLES FOR REFERENCE							
*M113A2	39	60	1	0	0	0	1	0	0	0	0	0
*XM723	70	28	1	0	0	0	1	0	0	0	0	0
*M551	55	43	2	0	0	0	1	0	0	0	0	0
M60A1	63	35	2	0	0	0	1	0	0	0	0	0
ALL	57	41	1	0	0	0	1	0	0	0	0	0

*SWIMMER
**DEEP FORDING AS-IS

TABLE E5

RELATIVE LEVEL OF ASSISTANCE LEVELS REQUIRED
WACROSS WEST GERMANY EAST-WEST AXES

CORRIDOR WIDTH: 2.0 KM. AXIS LENGTH: 208.1 KM.
FLOW STAGE: ALL

ASSIST REQD	PERCENT NONE (GO)	D7 EGRS	FILL FORD	WET EGRS	RIBB S-R	MAB S-R	BAIL BRDG	RIBB B/R	MGB	MAB B/R	AVLB	NOGO
VEHICLES AS-IS												
M151A2	0	89	11	0	0	0	1	0	0	0	0	0
M861	0	91	8	0	0	0	1	0	0	0	0	0
*M561	0	95	4	0	0	0	1	0	0	0	0	0
M35A2	0	94	5	0	0	0	1	0	0	0	0	0
M813	0	94	5	0	0	0	1	0	0	0	0	0
*M656	2	95	2	0	0	0	1	0	0	0	0	0
*M520E1	4	93	3	0	0	0	1	0	0	0	0	0
M125E1	0	94	5	0	0	0	1	0	0	0	0	0
M818/M125	0	94	5	0	0	0	1	0	0	0	0	0
TD901	2	95	2	0	0	0	1	0	0	0	0	0
M548E1**	38	61	1	0	0	0	0	0	0	0	0	0
ALL	4	90	5	0	0	0	1	0	0	0	0	0
VEHICLES WITH DEEP FORDING												
M151A2	0	89	11	0	0	0	1	0	0	0	0	0
M861	0	91	8	0	0	0	1	0	0	0	0	0
*M561	0	95	5	0	0	0	1	0	0	0	0	0
M35A2	0	96	4	0	0	0	1	0	0	0	0	0
M813	0	96	3	0	0	0	1	0	0	0	0	0
*M656	2	95	2	0	0	0	1	0	0	0	0	0
*M520E1	4	93	2	0	0	0	1	0	0	0	0	0
M125E1	0	96	2	1	0	0	1	0	0	0	0	0
M818/M125	0	97	2	0	0	0	1	0	0	0	0	0
TD901	2	95	2	0	0	0	1	0	0	0	0	0
M548E1**	38	61	1	0	0	0	0	0	0	0	0	0
ALL	4	91	4	0	0	0	1	0	0	0	0	0
VEHICLES FOR REFERENCE												
*M113A2	38	61	1	0	0	0	0	0	0	0	0	0
*XM723	75	24	1	0	0	0	0	0	0	0	0	0
*M551	62	36	2	0	0	0	0	0	0	0	0	0
M60A1	72	27	2	0	0	0	0	0	0	0	0	0
ALL	62	37	1	0	0	0	0	0	0	0	0	0

*SWIMMER
**DEEP FORDING AS-IS

TABLE E6

RELATIVE LEVEL OF ASSISTANCE LEVELS REQUIRED
ACROSS WEST GERMANY EAST-WEST AXES

CORRIDOR WIDTH: 4.0 KM. AXIS LENGTH: 208.1 KM.
FLOW STAGE: ALL

PERCENT

ASSIST REQD	NONE (GO)	D7 EGRS	FILL FORD	WET EGRS	RIBB S-R	MAB S-R	BAIL BRDG	RIBB B/R	MGB	MAB B/R	AVLB	NOGO
					VEHICLES AS-IS							
M151A2	0	88	11	0	0	0	1	0	0	0	0	0
M861	0	90	9	0	0	0	1	0	0	0	0	0
*M561	0	93	6	0	0	0	1	0	0	0	0	0
M35A2	1	92	7	0	0	0	1	0	0	0	0	0
M813	0	93	7	0	0	0	1	0	0	0	0	0
*M656	2	94	3	0	0	0	1	0	0	0	0	0
*M520E1	2	93	4	0	0	0	1	0	0	0	0	0
M125E1	0	93	7	0	0	0	1	0	0	0	0	0
M818/M125	0	93	7	0	0	0	1	0	0	0	0	0
TD901	4	92	3	0	0	0	1	0	0	0	0	0
M548E1**	55	44	2	0	0	0	0	0	0	0	0	0
ALL	6	88	6	0	0	0	1	0	0	0	0	0
					VEHICLES WITH DEEP FORDING							
M151A2	0	88	11	0	0	0	1	0	0	0	0	0
M861	0	90	9	0	0	0	1	0	0	0	0	0
*M561	0	93	6	0	0	0	1	0	0	0	0	0
M35A2	2	94	4	0	0	0	1	0	0	0	0	0
M813	0	95	4	0	0	0	1	0	0	0	0	0
*M656	2	94	3	0	0	0	1	0	0	0	0	0
*M520E1	2	94	3	0	0	0	1	0	0	0	0	0
M125E1	0	95	4	1	0	0	0	0	0	0	0	0
M818/M125	0	95	4	1	0	0	0	0	0	0	0	0
TD901	4	92	3	1	0	0	0	0	0	0	0	0
M548E1**	55	44	2	0	0	0	0	0	0	0	0	0
ALL	6	88	5	0	0	0	1	0	0	0	0	0
					VEHICLES FOR REFERENCE							
*M113A2	53	46	2	0	0	0	0	0	0	0	0	0
*XM723	82	16	2	0	0	0	0	0	0	0	0	0
*M551	70	29	1	0	0	0	0	0	0	0	0	0
M60A1	74	25	2	0	0	0	0	0	0	0	0	0
ALL	69	29	2	0	0	0	0	0	0	0	0	0

*SWIMMER
**DEEP FORDING AS-IS

TABLE E7

CROSSING PERFORMANCE STATISTICS
WACROSS WEST GERMANY NORTH-SOUTH AXES

CORRIDOR WIDTH: 1.0 KM. AXIS LENGTH: 223.1 KM.

FLOW STAGE	PERCENT OF CROSSINGS GO HIGH	AVER	LOW	ALL	MEAN NO-GO PENALTY PER KILOMETER HIGH	AVER	LOW	ALL	MEAN KILOMETERS PER NO-GO CROSSING HIGH	AVER	LOW	ALL
VEHICLES AS-IS												
M151A2	0	0	0	0	150	122	103	125	2.1	2.1	2.1	2.1
M861	0	0	0	0	146	121	102	123	2.1	2.1	2.1	2.1
*M561	0	0	0	0	137	105	101	114	2.1	2.1	2.1	2.1
M35A2	0	0	0	0	139	121	101	120	2.1	2.1	2.1	2.1
M813	0	0	0	0	139	121	101	120	2.1	2.1	2.1	2.1
*M656	1	0	8	3	128	105	94	109	2.1	2.1	2.3	2.2
*M520E1	5	5	1	3	125	100	100	108	2.1	2.2	2.1	2.2
M125E1	0	0	0	0	139	121	101	120	2.1	2.1	2.1	2.1
M818/M125	0	0	0	0	139	121	101	120	2.1	2.1	2.1	2.1
TD901	0	0	2	1	130	105	99	111	2.1	2.1	2.2	2.1
M548E1**	39	36	40	38	73	72	64	70	3.4	3.2	3.5	3.4
ALL	4	4	5	4	131	111	97	113	2.2	2.2	2.2	2.2
VEHICLES WITH DEEP FORDING												
M151A2	0	0	0	0	150	122	103	125	2.1	2.1	2.1	2.1
M861	0	0	0	0	146	121	102	123	2.1	2.1	2.1	2.1
*M561	0	0	0	0	138	105	101	114	2.2	2.1	2.1	2.1
M35A2	0	0	0	0	137	105	101	114	2.1	2.1	2.1	2.1
M813	0	0	0	0	137	105	101	114	2.1	2.1	2.1	2.1
*M656	0	0	8	3	131	105	94	110	2.1	2.1	2.3	2.2
*M520E1	5	5	1	3	125	100	100	108	2.1	2.2	2.1	2.2
M125E1	0	0	0	0	121	105	101	109	2.0	2.1	2.1	2.1
M818/M125	0	0	0	0	121	105	101	109	2.0	2.1	2.1	2.1
TD901	0	0	2	1	113	105	99	106	2.1	2.1	2.2	2.1
M548E1**	39	36	40	38	73	72	64	70	3.4	3.2	3.5	3.4
ALL	4	4	5	4	126	105	97	109	2.2	2.2	2.2	2.2
VEHICLES FOR REFERENCE												
*M113A2	38	38	41	39	78	70	63	71	3.3	3.3	3.5	3.4
*XM723	75	78	78	77	48	30	27	35	8.3	9.3	9.7	9.0
*M551	60	47	51	53	57	61	53	57	5.1	3.9	4.3	4.4
M60A1	64	67	69	67	64	41	36	47	5.9	6.2	6.8	6.3
ALL	59	57	60	59	62	51	45	53	5.0	4.8	5.2	5.0

*SWIMMER
**DEEP FORDING AS-IS

TABLE E8

CROSSING PERFORMANCE STATISTICS
WACROSS WEST GERMANY NORTH-SOUTH AXES

CORRIDOR WIDTH: 2.0 KM. AXIS LENGTH: 223.1 KM.

FLOW STAGE	PERCENT OF CROSSINGS GO HIGH	AVER	LOW	ALL	MEAN NO-GO PENALTY PER KILOMETER HIGH	AVER	LOW	ALL	MEAN KILOMETERS PER NO-GO CROSSING HIGH	AVER	LOW	ALL
VEHICLES AS-IS												
M151A2	0	0	0	0	92	65	61	73	3.1	3.5	3.7	3.4
M861	0	0	0	0	88	62	61	71	3.1	3.6	3.5	3.4
*M561	0	0	0	0	78	61	61	66	3.3	3.7	3.4	3.5
M35A2	0	0	0	0	79	62	61	67	3.2	3.6	3.4	3.4
M813	0	0	0	0	79	62	61	67	3.2	3.6	3.4	3.4
*M656	1	0	3	2	68	61	59	63	3.4	3.7	3.5	3.5
*M520E1	10	11	3	8	69	55	59	61	3.5	4.1	3.5	3.7
M125E1	0	0	0	0	79	62	61	67	3.2	3.6	3.4	3.4
M818/M125	0	0	0	0	79	62	61	67	3.2	3.6	3.4	3.4
TD901	0	0	8	3	69	61	56	62	3.3	3.7	3.7	3.6
M548E1**	38	39	47	41	45	40	35	40	5.2	5.6	6.2	5.6
ALL	4	5	6	5	75	60	58	64	3.4	3.8	3.7	3.6
VEHICLES WITH DEEP FORDING												
M151A2	0	0	0	0	92	65	61	73	3.1	3.5	3.7	3.4
M861	0	0	0	0	88	62	61	71	3.1	3.6	3.5	3.4
*M561	0	0	0	0	78	61	61	66	3.3	3.7	3.4	3.5
M35A2	0	0	0	0	77	61	61	66	3.2	3.7	3.4	3.4
M813	0	0	0	0	77	61	61	66	3.2	3.7	3.4	3.4
*M656	0	0	3	1	71	61	59	64	3.3	3.7	3.5	3.5
*M520E1	10	11	3	8	69	55	59	61	3.5	4.1	3.5	3.7
M125E1	0	0	0	0	74	61	61	65	3.2	3.7	3.4	3.4
M818/M125	0	0	0	0	74	61	61	65	3.2	3.7	3.4	3.4
TD901	0	0	8	3	67	61	56	62	3.3	3.7	3.7	3.6
M548E1**	38	39	47	41	45	40	35	40	5.2	5.6	6.2	5.6
ALL	4	5	6	5	74	59	58	64	3.4	3.8	3.7	3.6
VEHICLES FOR REFERENCE												
*M113A2	39	41	50	43	45	39	33	39	5.2	5.7	6.6	5.8
*XM723	73	71	74	73	24	22	18	21	11.7	11.7	12.4	11.9
*M551	67	56	64	63	29	32	26	29	8.9	7.2	8.6	8.2
M60A1	69	68	72	70	30	24	20	25	9.7	10.1	11.2	10.3
ALL	62	59	65	62	32	29	24	29	8.1	8.0	9.1	8.4

*SWIMMER
**DEEP FORDING AS-IS

TABLE B9

CROSSING PERFORMANCE STATISTICS
WACROSS WEST GERMANY NORTH-SOUTH AXES

CORRIDOR WIDTH: 4.0 KM. AXIS LENGTH: 223.1 KM.

	PERCENT OF CROSSINGS GO				MEAN NO-GO PENALTY PER KILOMETER				MEAN KILOMETERS PER NO-GO CROSSING			
FLOW STAGE	HIGH	AVER	LOW	ALL	HIGH	AVER	LOW	ALL	HIGH	AVER	LOW	ALL
VEHICLES AS-IS												
M151A2	0	0	0	0	61	41	37	46	4.8	5.1	5.4	5.1
M861	0	0	0	0	55	39	37	43	5.1	5.3	5.4	5.3
*M561	0	0	0	0	50	37	37	41	5.2	5.4	5.4	5.4
M35A2	0	0	0	0	52	39	37	42	5.0	5.3	5.4	5.2
M813	0	0	0	0	52	39	37	42	5.0	5.3	5.4	5.2
*M656	5	0	0	2	39	37	37	38	5.4	5.4	5.4	5.4
*M520E1	4	7	0	4	46	34	37	39	4.5	5.9	5.4	5.2
M125E1	0	0	0	0	52	39	37	42	5.0	5.3	5.4	5.2
M818/M125	0	0	0	0	52	39	37	42	5.0	5.3	5.4	5.2
TD901	0	0	5	2	43	37	35	38	5.2	5.4	5.7	5.4
M548E1**	56	52	70	60	18	19	13	16	11.2	10.6	15.9	12.2
ALL	6	6	8	6	47	36	34	39	5.3	5.6	5.8	5.6
VEHICLES WITH DEEP FORDING												
M151A2	0	0	0	0	61	41	37	46	4.8	5.1	5.4	5.1
M861	0	0	0	0	55	39	37	43	5.1	5.3	5.4	5.3
*M561	0	0	0	0	50	37	37	41	5.2	5.4	5.4	5.4
M35A2	0	0	0	0	50	37	37	41	5.2	5.4	5.4	5.4
M813	0	0	0	0	50	37	37	41	5.2	5.4	5.4	5.4
*M656	0	0	0	0	43	37	37	39	5.4	5.4	5.4	5.4
*M520E1	4	7	0	4	46	34	37	39	4.5	5.9	5.4	5.2
M125E1	0	0	0	0	47	37	37	40	4.8	5.4	5.4	5.2
M818/M125	0	0	0	0	47	37	37	40	4.8	5.4	5.4	5.2
TD901	0	0	5	2	40	37	35	37	5.1	5.4	5.7	5.4
M548E1**	56	52	70	60	18	19	13	16	11.2	10.6	15.9	12.2
ALL	5	6	8	6	46	35	34	39	5.3	5.7	5.8	5.6
VEHICLES FOR REFERENCE												
*M113A2	52	52	72	59	20	19	12	17	10.1	10.6	17.2	11.9
*XM723	73	73	84	77	11	11	6	9	18.6	18.6	31.9	21.6
*M551	67	61	79	69	13	16	9	13	14.9	12.4	22.3	15.6
M60A1	73	73	84	77	11	11	6	9	18.6	18.6	31.9	21.6
ALL	66	65	80	70	14	14	8	12	14.6	14.2	24.1	16.6

*SWIMMER
**DEEP FORDING AS-IS

TABLE E10

RELATIVE LEVEL OF ASSISTANCE LEVELS REQUIRED
WACROSS WEST GERMANY NORTH-SOUTH AXES

CORRIDOR WIDTH: 1.0 KM. AXIS LENGTH: 223.1 KM.
FLOW STAGE: ALL

ASSIST REQD	PERCENT NONE (GO)	D7 EGRS	FILL FORD	UET EGRS	RIBB S-R	MAB S-R	BAIL BRDG	RIBB B/R	MGB	MAB B/R	AVLB	NOGO
					VEHICLES AS-IS							
M151A2	0	91	7	0	0	0	2	0	0	0	0	0
M861	0	91	7	0	0	0	2	0	0	0	0	0
*M561	0	95	4	0	0	0	1	0	0	0	0	0
M35A2	0	94	4	0	0	0	2	0	0	0	0	0
M813	0	94	4	0	0	0	2	0	0	0	0	0
*M656	3	93	3	0	0	0	1	0	0	0	0	0
*M520E1	3	92	3	0	0	0	1	0	0	0	0	0
M125E1	0	94	4	0	0	0	2	0	0	0	0	0
M818/M125	0	94	4	0	0	0	2	0	0	0	0	0
TD901	1	95	3	0	0	0	1	0	0	0	0	0
M548E1**	38	59	2	0	0	0	1	0	0	0	0	0
ALL	4	90	4	0	0	0	2	0	0	0	0	0
					VEHICLES WITH DEEP FORDING							
M151A2	0	91	7	0	0	0	2	0	0	0	0	0
M861	0	91	7	0	0	0	2	0	0	0	0	0
*M561	0	94	4	0	0	0	1	0	0	0	0	0
M35A2	0	95	4	0	0	0	1	0	0	0	0	0
M813	0	95	4	0	0	0	1	0	0	0	0	0
*M656	3	93	3	0	0	0	1	0	0	0	0	0
*M520E1	3	92	3	0	0	0	1	0	0	0	0	0
M125E1	0	96	3	0	0	0	1	0	0	0	0	0
M818/M125	0	96	3	0	0	0	1	0	0	0	0	0
TD901	1	96	3	0	0	0	1	0	0	0	0	0
M548E1**	38	59	2	0	0	0	1	0	0	0	0	0
ALL	4	91	4	0	0	0	1	0	0	0	0	0
					VEHICLES FOR REFERENCE							
*M113A2	39	58	2	0	0	0	1	0	0	0	0	0
*XM723	77	19	3	0	0	0	1	0	0	0	0	0
*M551	53	44	3	0	0	0	1	0	0	0	0	0
M60A1	67	29	4	0	0	0	1	0	0	0	0	0
ALL	59	37	3	0	0	0	1	0	0	0	0	0

*SWIMMER
**DEEP FORDING AS-IS

TABLE E11

RELATIVE LEVEL OF ASSISTANCE LEVELS REQUIRED
WACROSS WEST GERMANY NORTH-SOUTH AXES

CORRIDOR WIDTH: 2.0 KM. AXIS LENGTH: 223.1 KM.
FLOW STAGE: ALL

ASSIST REQD	PERCENT NONE (GO)	D7 EGRS	FILL FORD	WET EGRS	RIBB S-R	MAB S-R	BAIL BRDG	RIBB B/R	MGB	MAB B/R	AVLB	NOGO
					VEHICLES AS-IS							
M151A2	0	89	10	0	0	0	1	0	0	0	0	0
M861	0	92	8	0	0	0	1	0	0	0	0	0
*M561	0	95	5	0	0	0	1	0	0	0	0	0
M35A2	0	95	5	0	0	0	1	0	0	0	0	0
M813	0	95	5	0	0	0	1	0	0	0	0	0
*M656	2	95	3	0	0	0	1	0	0	0	0	0
*M520E1	8	88	4	0	0	0	1	0	0	0	0	0
M125E1	0	95	5	0	0	0	1	0	0	0	0	0
M818/M125	0	95	5	0	0	0	1	0	0	0	0	0
TD901	3	94	3	0	0	0	1	0	0	0	0	0
M548E1**	41	57	1	0	0	0	0	0	0	0	0	0
ALL	5	90	5	0	0	0	1	0	0	0	0	0
					VEHICLES WITH DEEP FORDING							
M151A2	0	89	10	0	0	0	1	0	0	0	0	0
M861	0	92	8	0	0	0	1	0	0	0	0	0
*M561	0	95	5	0	0	0	1	0	0	0	0	0
M35A2	0	95	4	0	0	0	1	0	0	0	0	0
M813	0	95	4	0	0	0	1	0	0	0	0	0
*M656	1	95	3	0	0	0	1	0	0	0	0	0
*M520E1	8	88	4	0	0	0	1	0	0	0	0	0
M125E1	0	96	4	0	0	0	1	0	0	0	0	0
M818/M125	0	96	4	0	0	0	1	0	0	0	0	0
TD901	3	94	3	0	0	0	1	0	0	0	0	0
M548E1**	41	57	1	0	0	0	0	0	0	0	0	0
ALL	5	90	4	0	0	0	1	0	0	0	0	0
					VEHICLES FOR REFERENCE							
*M113A2	43	55	1	0	0	0	0	0	0	0	0	0
*XM723	73	25	2	0	0	0	0	0	0	0	0	0
*M551	63	36	1	0	0	0	0	0	0	0	0	0
M60A1	70	27	2	0	0	0	0	0	0	0	0	0
ALL	62	36	2	0	0	0	0	0	0	0	0	0

*SWIMMER
**DEEP FORDING AS-IS

TABLE E12

RELATIVE LEVEL OF ASSISTANCE LEVELS REQUIRED
WACROSS WEST GERMANY NORTH-SOUTH AXES

CORRIDOR WIDTH: 4.0 KM. AXIS LENGTH: 223.1 KM.
FLOW STAGE: ALL

ASSIST REQD	PERCENT NONE (GO)	D7 EGRS	FILL FORD	WET EGRS	RIBB S-R	MAB S-R	BAIL BRDG	RIBB B/R	MGB	MAB B/R	AVLB	NOGO
VEHICLES AS-IS												
M151A2	0	90	10	0	0	0	0	0	0	0	0	0
M861	0	93	7	0	0	0	0	0	0	0	0	0
*M561	0	96	4	0	0	0	0	0	0	0	0	0
M35A2	0	95	5	0	0	0	0	0	0	0	0	0
M813	0	95	5	0	0	0	0	0	0	0	0	0
*M656	2	98	1	0	0	0	0	0	0	0	0	0
*M520E1	4	96	1	0	0	0	0	0	0	0	0	0
M125E1	0	95	5	0	0	0	0	0	0	0	0	0
M818/M125	0	95	5	0	0	0	0	0	0	0	0	0
TD901	2	96	2	0	0	0	0	0	0	0	0	0
M548E1**	60	40	0	0	0	0	0	0	0	0	0	0
ALL	6	90	4	0	0	0	0	0	0	0	0	0
VEHICLES WITH DEEP FORDING												
M151A2	0	90	10	0	0	0	0	0	0	0	0	0
M861	0	93	7	0	0	0	0	0	0	0	0	0
*M561	0	96	4	0	0	0	0	0	0	0	0	0
M35A2	0	96	4	0	0	0	0	0	0	0	0	0
M813	0	96	4	0	0	0	0	0	0	0	0	0
*M656	0	98	2	0	0	0	0	0	0	0	0	0
*M520E1	4	96	1	0	0	0	0	0	0	0	0	0
M125E1	0	98	2	0	0	0	0	0	0	0	0	0
M818/M125	0	98	2	0	0	0	0	0	0	0	0	0
TD901	2	98	1	0	0	0	0	0	0	0	0	0
M548E1**	60	40	0	0	0	0	0	0	0	0	0	0
ALL	6	90	3	0	0	0	0	0	0	0	0	0
VEHICLES FOR REFERENCE												
*M113A2	59	41	0	0	0	0	0	0	0	0	0	0
*XM723	77	23	0	0	0	0	0	0	0	0	0	0
*M551	69	31	0	0	0	0	0	0	0	0	0	0
M60A1	77	23	0	0	0	0	0	0	0	0	0	0
ALL	70	30	0	0	0	0	0	0	0	0	0	0

*SWIMMER
**DEEP FORDING AS-IS

TABLE E13

RELATIVE LEVEL OF ASSISTANCE LEVELS REQUIRED
WACROSS WEST GERMANY EAST-WEST AXES

CORRIDOR WIDTH: 1.0 KM. AXIS LENGTH: 208.1 KM.
FLOW STAGE: HIGH

ASSIST REQD	PERCENT NONE (GO)	D7 EGRS	FILL FORD	UET EGRS	RIBB S-R	MAB S-R	BAIL BRDG	RIBB B/R	MGB	MAB B/R	AVLB	NOGO
VEHICLES AS-IS												
M151A2	0	74	21	0	0	0	4	0	0	0	0	0
M861	0	80	15	0	0	0	4	0	0	0	0	0
*M561	0	91	5	0	0	0	5	0	0	0	0	0
M35A2	0	89	7	0	0	0	4	0	0	0	0	0
M813	0	89	7	0	0	0	4	0	0	0	0	0
*M656	0	93	2	0	0	0	5	0	0	0	0	0
*M520E1	10	83	2	0	0	0	5	0	0	0	0	0
M125E1	0	89	7	0	0	0	4	0	0	0	0	0
M818/M125	0	89	7	0	0	0	4	0	0	0	0	0
TD901	1	92	2	0	0	0	5	0	0	0	0	0
M548E1**	41	59	0	0	0	0	0	0	0	0	0	0
ALL	5	84	7	0	0	0	4	0	0	0	0	0
VEHICLES WITH DEEP FORDING												
M151A2	0	74	21	0	0	0	4	0	0	0	0	0
M861	0	80	15	0	0	0	4	0	0	0	0	0
*M561	0	90	6	0	0	0	5	0	0	0	0	0
M35A2	0	92	3	0	0	0	4	0	0	0	0	0
M813	0	92	3	0	0	0	4	0	0	0	0	0
*M656	0	93	2	0	0	0	5	0	0	0	0	0
*M520E1	10	84	1	0	0	0	5	0	0	0	0	0
M125E1	0	94	2	0	0	0	3	0	0	0	0	0
M818/M125	0	93	2	0	0	0	5	0	0	0	0	0
TD901	1	95	1	0	0	0	2	0	0	0	0	0
M548E1**	41	59	0	0	0	0	0	0	0	0	0	0
ALL	5	86	5	0	0	0	4	0	0	0	0	0
VEHICLES FOR REFERENCE												
*M113A2	38	61	0	0	0	0	1	0	0	0	0	0
*XM723	67	32	0	0	0	0	1	0	0	0	0	0
*M551	55	43	1	0	0	0	1	0	0	0	0	0
M60A1	59	36	3	0	0	0	1	0	0	0	0	0
ALL	55	43	1	0	0	0	1	0	0	0	0	0

*SWIMMER
**DEEP FORDING AS-IS

TABLE E14

RELATIVE LEVEL OF ASSISTANCE LEVELS REQUIRED
WACROSS WEST GERMANY EAST-WEST AXES

CORRIDOR WIDTH: 1.0 KM. AXIS LENGTH: 208.1 KM.
FLOW STAGE: AVERAGE

ASSIST REQD	PERCENT NONE (GO)	D7 EGRS	FILL FORD	UET EGRS	RIBB S-R	MAB S-R	BAIL BRDG	RIBB B/R	MGB	MAB B/R	AVLB	NOGO
					VEHICLES AS-IS							
M151A2	0	92	7	0	0	0	1	0	0	0	0	0
M861	0	93	6	0	0	0	1	0	0	0	0	0
*M561	0	95	5	0	0	0	0	0	0	0	0	0
M35A2	0	93	6	0	0	0	1	0	0	0	0	0
M813	0	93	6	0	0	0	1	0	0	0	0	0
*M656	1	95	4	0	0	0	0	0	0	0	0	0
*M520E1	10	87	4	0	0	0	0	0	0	0	0	0
M125E1	0	93	6	0	0	0	1	0	0	0	0	0
M818/M125	0	93	6	0	0	0	1	0	0	0	0	0
TD901	1	95	4	0	0	0	0	0	0	0	0	0
M548E1**	36	61	2	0	0	0	0	0	0	0	0	0
ALL	5	90	5	0	0	0	1	0	0	0	0	0
				VEHICLES WITH DEEP FORDING								
M151A2	0	92	7	0	0	0	1	0	0	0	0	0
M861	0	93	6	0	0	0	1	0	0	0	0	0
*M561	0	95	5	0	0	0	0	0	0	0	0	0
M35A2	0	96	4	0	0	0	0	0	0	0	0	0
M813	0	96	4	0	0	0	0	0	0	0	0	0
*M656	1	95	4	0	0	0	0	0	0	0	0	0
*M520E1	10	87	4	0	0	0	0	0	0	0	0	0
M125E1	0	96	4	0	0	0	0	0	0	0	0	0
M818/M125	0	96	4	0	0	0	0	0	0	0	0	0
TD901	1	95	4	0	0	0	0	0	0	0	0	0
M548E1**	36	61	2	0	0	0	0	0	0	0	0	0
ALL	5	91	4	0	0	0	0	0	0	0	0	0
				VEHICLES FOR REFERENCE								
*M113A2	36	61	2	0	0	0	0	0	0	0	0	0
*XM723	70	27	2	0	0	0	0	0	0	0	0	0
*M551	52	45	3	0	0	0	0	0	0	0	0	0
M60A1	62	36	2	0	0	0	0	0	0	0	0	0
ALL	55	43	3	0	0	0	0	0	0	0	0	0

*SWIMMER
**DEEP FORDING AS-IS

TABLE E15

RELATIVE LEVEL OF ASSISTANCE LEVELS REQUIRED
WACROSS WEST GERMANY EAST-WEST AXES

CORRIDOR WIDTH: 1.0 KM. AXIS LENGTH: 208.1 KM.
FLOW STAGE: LOW

ASSIST REQD	PERCENT NONE (GO)	D7 EGRS	FILL FORD	WET EGRS	RIBB S-R	MAB S-R	BAIL BRDG	RIBB B/R	MGB	MAB B/R	AVLB	NOGO
VEHICLES AS-IS												
M151A2	0	98	1	0	0	0	1	0	0	0	0	0
M861	0	98	1	0	0	0	1	0	0	0	0	0
*M561	0	98	1	0	0	0	1	0	0	0	0	0
M35A2	1	96	1	0	0	0	1	0	0	0	0	0
M813	0	98	1	0	0	0	1	0	0	0	0	0
*M656	3	95	0	0	0	0	1	0	0	0	0	0
*M520E1	7	92	0	0	0	0	1	0	0	0	0	0
M125E1	0	98	1	0	0	0	1	0	0	0	0	0
M818/M125	0	98	1	0	0	0	1	0	0	0	0	0
TD901	6	93	0	0	0	0	1	0	0	0	0	0
M548E1**	40	59	0	0	0	0	1	0	0	0	0	0
ALL	5	93	1	0	0	0	1	0	0	0	0	0
VEHICLES WITH DEEP FORDING												
M151A2	0	98	1	0	0	0	1	0	0	0	0	0
M861	0	98	1	0	0	0	1	0	0	0	0	0
*M561	0	98	1	0	0	0	1	0	0	0	0	0
M35A2	1	98	0	0	0	0	1	0	0	0	0	0
M813	0	99	0	0	0	0	1	0	0	0	0	0
*M656	3	95	0	0	0	0	1	0	0	0	0	0
*M520E1	7	92	0	0	0	0	1	0	0	0	0	0
M125E1	0	99	0	0	0	0	1	0	0	0	0	0
M818/M125	0	99	0	0	0	0	1	0	0	0	0	0
TD901	6	93	0	0	0	0	1	0	0	0	0	0
M548E1**	40	59	0	0	0	0	1	0	0	0	0	0
ALL	5	93	0	0	0	0	1	0	0	0	0	0
VEHICLES FOR REFERENCE												
*M113A2	42	57	0	0	0	0	1	0	0	0	0	0
*XM723	74	24	0	0	0	0	1	0	0	0	0	0
*M551	58	40	0	0	0	0	1	0	0	0	0	0
M60A1	66	33	0	0	0	0	1	0	0	0	0	0
ALL	60	39	0	0	0	0	1	0	0	0	0	0

*SWIMMER
**DEEP FORDING AS-IS

TABLE E16

RELATIVE LEVEL OF ASSISTANCE LEVELS REQUIRED
WACROSS WEST GERMANY EAST-WEST AXES

CORRIDOR WIDTH: 2.0 KM. AXIS LENGTH: 208.1 KM.
FLOW STAGE: HIGH

ASSIST REQD	PERCENT NONE (GO)	D7 EGRS	FILL FORD	UET EGRS	RIBB S-R	MAB S-R	BAIL BRDG	RIBB B/R	MGB	MAB B/R	AVLB	NOGO
				VEHICLES AS-IS								
M151A2	0	78	21	0	0	0	2	0	0	0	0	0
M861	0	83	15	0	0	0	2	0	0	0	0	0
*M561	0	93	5	0	0	0	2	0	0	0	0	0
M35A2	0	92	7	0	0	0	2	0	0	0	0	0
M813	0	92	7	0	0	0	2	0	0	0	0	0
*M656	0	95	3	0	0	0	2	0	0	0	0	0
*M520E1	5	88	5	0	0	0	2	0	0	0	0	0
M125E1	0	92	7	0	0	0	2	0	0	0	0	0
M818/M125	0	92	7	0	0	0	2	0	0	0	0	0
TD901	0	95	3	0	0	0	2	0	0	0	0	0
M548E1**	40	60	0	0	0	0	0	0	0	0	0	0
ALL	4	87	7	0	0	0	2	0	0	0	0	0
				VEHICLES WITH DEEP FORDING								
M151A2	0	78	21	0	0	0	2	0	0	0	0	0
M861	0	83	15	0	0	0	2	0	0	0	0	0
*M561	0	92	7	0	0	0	2	0	0	0	0	0
M35A2	0	91	7	0	0	0	2	0	0	0	0	0
M813	0	93	5	0	0	0	2	0	0	0	0	0
*M656	0	95	3	0	0	0	2	0	0	0	0	0
*M520E1	5	90	3	0	0	0	2	0	0	0	0	0
M125E1	0	93	4	2	0	0	2	0	0	0	0	0
M818/M125	0	95	3	0	0	0	2	0	0	0	0	0
TD901	0	97	2	0	0	0	2	0	0	0	0	0
M548E1**	40	60	0	0	0	0	0	0	0	0	0	0
ALL	4	88	7	0	0	0	2	0	0	0	0	0
				VEHICLES FOR REFERENCE								
*M113A2	37	63	0	0	0	0	0	0	0	0	0	0
*XM723	72	28	0	0	0	0	0	0	0	0	0	0
*M551	66	32	2	0	0	0	0	0	0	0	0	0
M60A1	69	29	2	0	0	0	0	0	0	0	0	0
ALL	61	38	1	0	0	0	0	0	0	0	0	0

*SWIMMER
**DEEP FORDING AS-IS

TABLE E17

RELATIVE LEVEL OF ASSISTANCE LEVELS REQUIRED
WACROSS WEST GERMANY EAST-WEST AXES

CORRIDOR WIDTH: 2.0 KM. AXIS LENGTH: 208.1 KM.
FLOW STAGE: AVERAGE

ASSIST REQD	PERCENT NONE (GO)	D7 EGRS	FILL FORD	WET EGRS	RIBB S-R	MAB S-R	BAIL BRDG	RIBB B/R	MGB	MAB B/R	AVLB	NOGO
VEHICLES AS-IS												
M151A2	0	91	9	0	0	0	0	0	0	0	0	0
M861	0	91	9	0	0	0	0	0	0	0	0	0
*M561	0	92	8	0	0	0	0	0	0	0	0	0
M35A2	0	91	9	0	0	0	0	0	0	0	0	0
M813	0	91	9	0	0	0	0	0	0	0	0	0
*M656	2	95	4	0	0	0	0	0	0	0	0	0
*M520E1	5	91	4	0	0	0	0	0	0	0	0	0
M125E1	0	91	9	0	0	0	0	0	0	0	0	0
M818/M125	0	91	9	0	0	0	0	0	0	0	0	0
TD901	0	96	4	0	0	0	0	0	0	0	0	0
M548E1**	36	61	3	0	0	0	0	0	0	0	0	0
ALL	4	89	7	0	0	0	0	0	0	0	0	0
VEHICLES WITH DEEP FORDING												
M151A2	0	91	9	0	0	0	0	0	0	0	0	0
M861	0	91	9	0	0	0	0	0	0	0	0	0
*M561	0	92	8	0	0	0	0	0	0	0	0	0
M35A2	0	96	4	0	0	0	0	0	0	0	0	0
M813	0	96	4	0	0	0	0	0	0	0	0	0
*M656	2	95	4	0	0	0	0	0	0	0	0	0
*M520E1	5	91	4	0	0	0	0	0	0	0	0	0
M125E1	0	96	4	0	0	0	0	0	0	0	0	0
M818/M125	0	96	4	0	0	0	0	0	0	0	0	0
TD901	0	96	4	0	0	0	0	0	0	0	0	0
M548E1**	36	61	3	0	0	0	0	0	0	0	0	0
ALL	4	91	5	0	0	0	0	0	0	0	0	0
VEHICLES FOR REFERENCE												
*M113A2	36	61	3	0	0	0	0	0	0	0	0	0
*XM723	75	21	4	0	0	0	0	0	0	0	0	0
*M551	57	40	3	0	0	0	0	0	0	0	0	0
M60A1	71	26	3	0	0	0	0	0	0	0	0	0
ALL	59	37	3	0	0	0	0	0	0	0	0	0

*SWIMMER
**DEEP FORDING AS-IS

TABLE E18

RELATIVE LEVEL OF ASSISTANCE LEVELS REQUIRED
WACROSS WEST GERMANY EAST-WEST AXES

CORRIDOR WIDTH: 2.0 KM. AXIS LENGTH: 208.1 KM.
FLOW STAGE: LOW

ASSIST REQD	PERCENT NONE (GO)	D7 EGRS	FILL FORD	WET EGRS	RIBB S-R	MAB S-R	BAIL BRDG	RIBB B/R	MGB	MAB B/R	AVLB	NOGO
VEHICLES AS-IS												
M151A2	0	100	0	0	0	0	0	0	0	0	0	0
M861	0	100	0	0	0	0	0	0	0	0	0	0
*M561	0	100	0	0	0	0	0	0	0	0	0	0
M35A2	0	100	0	0	0	0	0	0	0	0	0	0
M813	0	100	0	0	0	0	0	0	0	0	0	0
*M656	4	96	0	0	0	0	0	0	0	0	0	0
*M520E1	0	100	0	0	0	0	0	0	0	0	0	0
M125E1	0	100	0	0	0	0	0	0	0	0	0	0
M818/M125	0	100	0	0	0	0	0	0	0	0	0	0
TD901	8	92	0	0	0	0	0	0	0	0	0	0
M548E1**	39	61	0	0	0	0	0	0	0	0	0	0
ALL	5	96	0	0	0	0	0	0	0	0	0	0
VEHICLES WITH DEEP FORDING												
M151A2	0	100	0	0	0	0	0	0	0	0	0	0
M861	0	100	0	0	0	0	0	0	0	0	0	0
*M561	0	100	0	0	0	0	0	0	0	0	0	0
M35A2	0	100	0	0	0	0	0	0	0	0	0	0
M813	0	100	0	0	0	0	0	0	0	0	0	0
*M656	4	96	0	0	0	0	0	0	0	0	0	0
*M520E1	0	100	0	0	0	0	0	0	0	0	0	0
M125E1	0	100	0	0	0	0	0	0	0	0	0	0
M818/M125	0	100	0	0	0	0	0	0	0	0	0	0
TD901	8	92	0	0	0	0	0	0	0	0	0	0
M548E1**	39	61	0	0	0	0	0	0	0	0	0	0
ALL	5	95	0	0	0	0	0	0	0	0	0	0
VEHICLES FOR REFERENCE												
*M113A2	41	59	0	0	0	0	0	0	0	0	0	0
*XM723	77	23	0	0	0	0	0	0	0	0	0	0
*M551	63	37	0	0	0	0	0	0	0	0	0	0
M60A1	75	25	0	0	0	0	0	0	0	0	0	0
ALL	64	36	0	0	0	0	0	0	0	0	0	0

*SWIMMER
**DEEP FORDING AS-IS

TABLE E19

RELATIVE LEVEL OF ASSISTANCE LEVELS REQUIRED
WACROSS WEST GERMANY EAST-WEST AXES

CORRIDOR WIDTH: 4.0 KM. AXIS LENGTH: 208.1 KM.
FLOW STAGE: HIGH

PERCENT ASSIST REQD	NONE (GO)	D7 EGRS	FILL FORD	UEI EGRS	RIBB S-R	MAB S-R	BAIL BRDG	RIBB B/R	MGB	MAB B/R	AVLB	NOGO
VEHICLES AS-IS												
M151A2	0	78	20	0	0	0	2	0	0	0	0	0
M861	0	84	14	0	0	0	2	0	0	0	0	0
*M561	0	91	7	0	0	0	2	0	0	0	0	0
M35A2	0	91	7	0	0	0	2	0	0	0	0	0
M813	0	91	7	0	0	0	2	0	0	0	0	0
*M656	0	93	5	0	0	0	2	0	0	0	0	0
*M520E1	0	90	7	0	0	0	2	0	0	0	0	0
M125E1	0	91	7	0	0	0	2	0	0	0	0	0
M818/M125	0	91	7	0	0	0	2	0	0	0	0	0
TD901	0	93	5	0	0	0	2	0	0	0	0	0
M548E1**	52	48	0	0	0	0	0	0	0	0	0	0
ALL	5	85	8	0	0	0	2	0	0	0	0	0
VEHICLES WITH DEEP FORDING												
M151A2	0	78	20	0	0	0	2	0	0	0	0	0
M861	0	84	14	0	0	0	2	0	0	0	0	0
*M561	0	91	7	0	0	0	2	0	0	0	0	0
M35A2	0	91	7	0	0	0	2	0	0	0	0	0
M813	0	90	7	0	0	0	2	0	0	0	0	0
*M656	0	93	5	0	0	0	2	0	0	0	0	0
*M520E1	0	93	5	0	0	0	2	0	0	0	0	0
M125E1	0	90	7	2	0	0	0	0	0	0	0	0
M818/M125	0	90	7	2	0	0	0	0	0	0	0	0
TD901	0	93	5	2	0	0	0	0	0	0	0	0
M548E1**	52	48	0	0	0	0	0	0	0	0	0	0
ALL	5	85	8	1	0	0	1	0	0	0	0	0
VEHICLES FOR REFERENCE												
*M113A2	48	52	0	0	0	0	0	0	0	0	0	0
*XM723	80	20	0	0	0	0	0	0	0	0	0	0
*M551	65	35	0	0	0	0	0	0	0	0	0	0
M60A1	67	33	0	0	0	0	0	0	0	0	0	0
ALL	65	35	0	0	0	0	0	0	0	0	0	0

*SWIMMER
**DEEP FORDING AS-IS

TABLE E20

RELATIVE LEVEL OF ASSISTANCE LEVELS REQUIRED
WACROSS WEST GERMANY EAST-WEST AXES

CORRIDOR WIDTH: 4.0 KM. AXIS LENGTH: 208.1 KM.
FLOW STAGE: AVERAGE

ASSIST REQD	PERCENT NONE (GO)	D7 EGRS	FILL FORD	WET EGRS	RIBB S-R	MAB S-R	BAIL BRDG	RIBB B/R	MGB	MAB H/R	AVLB	NOGO
VEHICLES AS-IS												
M151A2	0	87	13	0	0	0	0	0	0	0	0	0
M861	0	87	13	0	0	0	0	0	0	0	0	0
*M561	0	89	11	0	0	0	0	0	0	0	0	0
M35A2	0	87	13	0	0	0	0	0	0	0	0	0
M813	0	87	13	0	0	0	0	0	0	0	0	0
*M656	2	93	5	0	0	0	0	0	0	0	0	0
*M520E1	2	93	5	0	0	0	0	0	0	0	0	0
M125E1	0	87	13	0	0	0	0	0	0	0	0	0
M818/M125	0	87	13	0	0	0	0	0	0	0	0	0
TD901	0	95	5	0	0	0	0	0	0	0	0	0
M548E1**	51	44	4	0	0	0	0	0	0	0	0	0
ALL	6	85	10	0	0	0	0	0	0	0	0	0
VEHICLES WITH DEEP FORDING												
M151A2	0	87	13	0	0	0	0	0	0	0	0	0
M861	0	87	13	0	0	0	0	0	0	0	0	0
*M561	0	89	11	0	0	0	0	0	0	0	0	0
M35A2	2	93	5	0	0	0	0	0	0	0	0	0
M813	0	95	5	0	0	0	0	0	0	0	0	0
*M656	2	93	5	0	0	0	0	0	0	0	0	0
*M520E1	2	93	5	0	0	0	0	0	0	0	0	0
M125E1	0	95	5	0	0	0	0	0	0	0	0	0
M818/M125	0	95	5	0	0	0	0	0	0	0	0	0
TD901	0	95	5	0	0	0	0	0	0	0	0	0
M548E1**	51	44	4	0	0	0	0	0	0	0	0	0
ALL	6	88	7	0	0	0	0	0	0	0	0	0
VEHICLES FOR REFERENCE												
*M113A2	48	48	4	0	0	0	0	0	0	0	0	0
*XM723	83	13	5	0	0	0	0	0	0	0	0	0
*M551	65	31	4	0	0	0	0	0	0	0	0	0
M60A1	73	23	5	0	0	0	0	0	0	0	0	0
ALL	66	29	5	0	0	0	0	0	0	0	0	0

*SWIMMER
**DEEP FORDING AS-IS

TABLE E21

RELATIVE LEVEL OF ASSISTANCE LEVELS REQUIRED
WACROSS WEST GERMANY EAST-WEST AXES

CORRIDOR WIDTH: 4.0 KM. AXIS LENGTH: 208.1 KM.
FLOW STAGE: LOW

ASSIST REQD	PERCENT NONE (GO)	D7 EGRS	FILL FORD	UET EGRS	RIBB S-R	MAB S-R	BAIL BRDG	RIBB B/R	MGB	MAB B/R	AVLB	NOGO
VEHICLES AS-IS												
M151A2	0	100	0	0	0	0	0	0	0	0	0	0
M861	0	100	0	0	0	0	0	0	0	0	0	0
*M561	0	100	0	0	0	0	0	0	0	0	0	0
M35A2	2	98	0	0	0	0	0	0	0	0	0	0
M813	0	100	0	0	0	0	0	0	0	0	0	0
*M656	3	98	0	0	0	0	0	0	0	0	0	0
*M520E1	3	98	0	0	0	0	0	0	0	0	0	0
M125E1	0	100	0	0	0	0	0	0	0	0	0	0
M818/M125	0	100	0	0	0	0	0	0	0	0	0	0
TD901	13	87	0	0	0	0	0	0	0	0	0	0
M548E1**	61	39	0	0	0	0	0	0	0	0	0	0
ALL	7	93	0	0	0	0	0	0	0	0	0	0
VEHICLES WITH DEEP FORDING												
M151A2	0	100	0	0	0	0	0	0	0	0	0	0
M861	0	100	0	0	0	0	0	0	0	0	0	0
*M561	0	100	0	0	0	0	0	0	0	0	0	0
M35A2	3	98	0	0	0	0	0	0	0	0	0	0
M813	0	100	0	0	0	0	0	0	0	0	0	0
*M656	3	98	0	0	0	0	0	0	0	0	0	0
*M520E1	3	98	0	0	0	0	0	0	0	0	0	0
M125E1	0	100	0	0	0	0	0	0	0	0	0	0
M818/M125	0	100	0	0	0	0	0	0	0	0	0	0
TD901	13	87	0	0	0	0	0	0	0	0	0	0
M548E1**	61	39	0	0	0	0	0	0	0	0	0	0
ALL	7	93	0	0	0	0	0	0	0	0	0	0
VEHICLES FOR REFERENCE												
*M113A2	63	37	0	0	0	0	0	0	0	0	0	0
*XM723	85	15	0	0	0	0	0	0	0	0	0	0
*M551	80	20	0	0	0	0	0	0	0	0	0	0
M60A1	82	18	0	0	0	0	0	0	0	0	0	0
ALL	77	23	0	0	0	0	0	0	0	0	0	0

*SWIMMER
**DEEP FORDING AS-IS

TABLE E22

RELATIVE LEVEL OF ASSISTANCE LEVELS REQUIRED
WACROSS WEST GERMANY NORTH-SOUTH AXES

CORRIDOR WIDTH: 1.0 KM. AXIS LENGTH: 223.1 KM.
FLOW STAGE: HIGH

ASSIST REQD	PERCENT NONE (GO)	D7 EGRS	FILL FORD	UEI EGRS	RIBB S-R	MAB S-R	BAIL BRDG	RIBB B/R	MGB	MAB B/R	AVLB	NOGO
VEHICLES AS-IS												
M151A2	0	82	14	0	0	0	4	0	0	0	0	0
M861	0	83	13	0	0	0	4	0	0	0	0	0
*M561	0	90	6	0	0	0	4	0	0	0	0	0
M35A2	0	89	7	0	0	0	4	0	0	0	0	0
M813	0	89	7	0	0	0	4	0	0	0	0	0
*M656	1	93	2	0	0	0	4	0	0	0	0	0
*M520E1	5	88	4	1	0	0	3	0	0	0	0	0
M125E1	0	89	7	0	0	0	4	0	0	0	0	0
M818/M125	0	89	7	0	0	0	4	0	0	0	0	0
TD901	0	93	3	0	0	0	4	0	0	0	0	0
M548E1**	39	58	1	0	0	0	2	0	0	0	0	0
ALL	4	86	6	0	0	0	4	0	0	0	0	0
VEHICLES WITH DEEP FORDING												
M151A2	0	82	14	0	0	0	4	0	0	0	0	0
M861	0	83	13	0	0	0	4	0	0	0	0	0
*M561	0	89	7	0	0	0	4	0	0	0	0	0
M35A2	0	92	5	0	0	0	4	0	0	0	0	0
M813	0	92	5	0	0	0	4	0	0	0	0	0
*M656	0	93	3	0	0	0	4	0	0	0	0	0
*M520E1	5	88	4	1	0	0	3	0	0	0	0	0
M125E1	0	94	4	1	0	0	2	0	0	0	0	0
M818/M125	0	94	4	1	0	0	2	0	0	0	0	0
TD901	0	95	2	1	0	0	2	0	0	0	0	0
M548E1**	39	58	1	0	0	0	2	0	0	0	0	0
ALL	4	87	5	0	0	0	3	0	0	0	0	0
VEHICLES FOR REFERENCE												
*M113A2	38	58	1	1	0	0	2	0	0	0	0	0
*XM723	75	20	2	0	0	0	3	0	0	0	0	0
*M551	60	36	1	1	0	0	2	0	0	0	0	0
M60A1	64	28	5	0	0	0	3	0	0	0	0	0
ALL	59	36	2	0	0	0	2	0	0	0	0	0

*SWIMMER
**DEEP FORDING AS-IS

TABLE E23

RELATIVE LEVEL OF ASSISTANCE LEVELS REQUIRED
WACROSS WEST GERMANY NORTH-SOUTH AXES

CORRIDOR WIDTH: 1.0 KM. AXIS LENGTH: 223.1 KM.
FLOW STAGE: AVERAGE

ASSIST REQD	PERCENT NONE (GO)	D7 EGRS	FILL FORD	UET EGRS	RIBB S-R	MAB S-R	BAIL BRDG	RIBB B/R	MGB	MAB B/R	AVLB	NUGO
VEHICLES AS-IS												
M151A2	0	93	4	0	0	0	3	0	0	0	0	0
M861	0	94	3	0	0	0	3	0	0	0	0	0
*M561	0	96	4	0	0	0	0	0	0	0	0	0
M35A2	0	94	3	0	0	0	3	0	0	0	0	0
M813	0	94	3	0	0	0	3	0	0	0	0	0
*M656	0	96	4	0	0	0	0	0	0	0	0	0
*M520E1	5	92	4	0	0	0	0	0	0	0	0	0
M125E1	0	94	3	0	0	0	3	0	0	0	0	0
M818/M125	0	94	3	0	0	0	3	0	0	0	0	0
TD901	0	96	4	0	0	0	0	0	0	0	0	0
M548E1**	36	61	4	0	0	0	0	0	0	0	0	0
ALL	4	91	3	0	0	0	2	0	0	0	0	0
VEHICLES WITH DEEP FORDING												
M151A2	0	93	4	0	0	0	3	0	0	0	0	0
M861	0	94	3	0	0	0	3	0	0	0	0	0
*M561	0	96	4	0	0	0	0	0	0	0	0	0
M35A2	0	96	4	0	0	0	0	0	0	0	0	0
M813	0	96	4	0	0	0	0	0	0	0	0	0
*M656	0	96	4	0	0	0	0	0	0	0	0	0
*M520E1	5	92	4	0	0	0	0	0	0	0	0	0
M125E1	0	96	4	0	0	0	0	0	0	0	0	0
M818/M125	0	96	4	0	0	0	0	0	0	0	0	0
TD901	0	96	4	0	0	0	0	0	0	0	0	0
M548E1**	36	61	4	0	0	0	0	0	0	0	0	0
ALL	4	92	4	0	0	0	1	0	0	0	0	0
VEHICLES FOR REFERENCE												
*M113A2	38	59	4	0	0	0	0	0	0	0	0	0
*XM723	78	19	4	0	0	0	0	0	0	0	0	0
*M551	47	48	5	0	0	0	0	0	0	0	0	0
M60A1	67	30	4	0	0	0	0	0	0	0	0	0
ALL	57	39	4	0	0	0	0	0	0	0	0	0

*SWIMMER
**DEEP FORDING AS-IS

TABLE E24

RELATIVE LEVEL OF ASSISTANCE LEVELS REQUIRED
WACROSS WEST GERMANY NORTH-SOUTH AXES

CORRIDOR WIDTH: 1.0 KM. AXIS LENGTH: 223.1 KM.
FLOW STAGE: LOW

ASSIST REQD	PERCENT NONE (GO)	D7 EGRS	FILL FORD	VEI EGRS	RIBB S-R	MAB S-R	BAIL BRDG	RIBB B/R	MGB	MAB B/R	AVLB	NOGO
					VEHICLES AS-IS							
M151A2	0	96	4	0	0	0	0	0	0	0	0	0
M861	0	96	4	0	0	0	0	0	0	0	0	0
*M561	0	97	3	0	0	0	0	0	0	0	0	0
M35A2	0	97	3	0	0	0	0	0	0	0	0	0
M813	0	97	3	0	0	0	0	0	0	0	0	0
*M656	8	90	3	0	0	0	0	0	0	0	0	0
*M520E1	1	96	3	0	0	0	0	0	0	0	0	0
M125E1	0	97	3	0	0	0	0	0	0	0	0	0
M818/M125	0	97	3	0	0	0	0	0	0	0	0	0
TD901	2	95	3	0	0	0	0	0	0	0	0	0
M548E1**	40	57	3	0	0	0	0	0	0	0	0	0
ALL	5	92	3	0	0	0	0	0	0	0	0	0
					VEHICLES WITH DEEP FORDING							
M151A2	0	96	4	0	0	0	0	0	0	0	0	0
M861	0	96	4	0	0	0	0	0	0	0	0	0
*M561	0	97	3	0	0	0	0	0	0	0	0	0
M35A2	0	97	3	0	0	0	0	0	0	0	0	0
M813	0	97	3	0	0	0	0	0	0	0	0	0
*M656	8	90	3	0	0	0	0	0	0	0	0	0
*M520E1	1	96	3	0	0	0	0	0	0	0	0	0
M125E1	0	97	3	0	0	0	0	0	0	0	0	0
M818/M125	0	97	3	0	0	0	0	0	0	0	0	0
TD901	2	95	3	0	0	0	0	0	0	0	0	0
M548E1**	40	57	3	0	0	0	0	0	0	0	0	0
ALL	5	92	3	0	0	0	0	0	0	0	0	0
					VEHICLES FOR REFERENCE							
*M113A2	41	56	3	0	0	0	0	0	0	0	0	0
*XM723	78	19	3	0	0	0	0	0	0	0	0	0
*M551	51	46	3	0	0	0	0	0	0	0	0	0
M60A1	69	28	3	0	0	0	0	0	0	0	0	0
ALL	60	37	3	0	0	0	0	0	0	0	0	0

*SWIMMER
**DEEP FORDING AS-IS

TABLE E25

RELATIVE LEVEL OF ASSISTANCE LEVELS REQUIRED
WACROSS WEST GERMANY NORTH-SOUTH AXES

CORRIDOR WIDTH: 2.0 KM. AXIS LENGTH: 223.1 KM.
FLOW STAGE: HIGH

ASSIST REQD	PERCENT NONE (GO)	D7 EGRS	FILL FORD	UET EGRS	RIBB S-R	MAB S-R	BAIL BRDG	RIBB B/R	MGB	MAB B/R	AVLB	NOGO
VEHICLES AS-IS												
M151A2	0	80	18	0	0	0	1	0	0	0	0	0
M861	0	85	14	0	0	0	1	0	0	0	0	0
*M561	0	91	7	0	0	0	1	0	0	0	0	0
M35A2	0	91	7	0	0	0	1	0	0	0	0	0
M813	0	91	7	0	0	0	1	0	0	0	0	0
*M656	1	96	1	0	0	0	1	0	0	0	0	0
*M520E1	10	85	4	0	0	0	1	0	0	0	0	0
M125E1	0	91	7	0	0	0	1	0	0	0	0	0
M818/M125	0	91	7	0	0	0	1	0	0	0	0	0
TD901	0	96	3	0	0	0	1	0	0	0	0	0
M548E1**	38	61	0	0	0	0	1	0	0	0	0	0
ALL	4	87	7	0	0	0	1	0	0	0	0	0
VEHICLES WITH DEEP FORDING												
M151A2	0	80	18	0	0	0	1	0	0	0	0	0
M861	0	85	14	0	0	0	1	0	0	0	0	0
*M561	0	91	7	0	0	0	1	0	0	0	0	0
M35A2	0	93	6	0	0	0	1	0	0	0	0	0
M813	0	93	6	0	0	0	1	0	0	0	0	0
*M656	0	96	3	0	0	0	1	0	0	0	0	0
*M520E1	10	85	4	0	0	0	1	0	0	0	0	0
M125E1	0	94	4	0	0	0	1	0	0	0	0	0
M818/M125	0	94	4	0	0	0	1	0	0	0	0	0
TD901	0	97	1	0	0	0	1	0	0	0	0	0
M548E1**	38	61	0	0	0	0	1	0	0	0	0	0
ALL	4	88	6	0	0	0	1	0	0	0	0	0
VEHICLES FOR REFERENCE												
*M113A2	39	59	0	0	0	0	1	0	0	0	0	0
*XM723	73	24	1	0	0	0	1	0	0	0	0	0
*M551	67	32	0	0	0	0	1	0	0	0	0	0
M60A1	69	27	3	0	0	0	1	0	0	0	0	0
ALL	62	35	1	0	0	0	1	0	0	0	0	0

*SWIMMER
**DEEP FORDING AS-IS

TABLE E26

RELATIVE LEVEL OF ASSISTANCE LEVELS REQUIRED
WACROSS WEST GERMANY NORTH-SOUTH AXES

CORRIDOR WIDTH: 2.0 KM. AXIS LENGTH: 223.1 KM.
FLOW STAGE: AVERAGE

ASSIST REQD	PERCENT NONE (GO)	D7 EGRS	FILL FORD	WET EGRS	RIBB S-R	MAB S-R	BAIL BRDG	RIBB B/R	MGB	MAB B/R	AVLB	NOGO
VEHICLES AS-IS												
M151A2	0	94	6	0	0	0	0	0	0	0	0	0
M861	0	95	5	0	0	0	0	0	0	0	0	0
*M561	0	95	5	0	0	0	0	0	0	0	0	0
M35A2	0	95	5	0	0	0	0	0	0	0	0	0
M813	0	95	5	0	0	0	0	0	0	0	0	0
*M656	0	95	5	0	0	0	0	0	0	0	0	0
*M520E1	11	84	5	0	0	0	0	0	0	0	0	0
M125E1	0	95	5	0	0	0	0	0	0	0	0	0
M818/M125	0	95	5	0	0	0	0	0	0	0	0	0
TD901	0	95	5	0	0	0	0	0	0	0	0	0
M548E1**	39	58	3	0	0	0	0	0	0	0	0	0
ALL	5	90	5	0	0	0	0	0	0	0	0	0
VEHICLES WITH DEEP FORDING												
M151A2	0	94	6	0	0	0	0	0	0	0	0	0
M861	0	95	5	0	0	0	0	0	0	0	0	0
*M561	0	95	5	0	0	0	0	0	0	0	0	0
M35A2	0	95	5	0	0	0	0	0	0	0	0	0
M813	0	95	5	0	0	0	0	0	0	0	0	0
*M656	0	95	5	0	0	0	0	0	0	0	0	0
*M520E1	11	84	5	0	0	0	0	0	0	0	0	0
M125E1	0	95	5	0	0	0	0	0	0	0	0	0
M818/M125	0	95	5	0	0	0	0	0	0	0	0	0
TD901	0	95	5	0	0	0	0	0	0	0	0	0
M548E1**	39	58	3	0	0	0	0	0	0	0	0	0
ALL	5	90	5	0	0	0	0	0	0	0	0	0
VEHICLES FOR REFERENCE												
*M113A2	41	56	3	0	0	0	0	0	0	0	0	0
*XM723	71	26	3	0	0	0	0	0	0	0	0	0
*M551	56	41	3	0	0	0	0	0	0	0	0	0
M60A1	68	29	3	0	0	0	0	0	0	0	0	0
ALL	59	38	3	0	0	0	0	0	0	0	0	0

*SWIMMER
**DEEP FORDING AS-IS

TABLE E27

RELATIVE LEVEL OF ASSISTANCE LEVELS REQUIRED
WACROSS WEST GERMANY NORTH-SOUTH AXFS

CORRIDOR WIDTH: 2.0 KM. AXIS LENGTH: 223.1 KM.
FLOW STAGE: LOW

ASSIST REQD	PERCENT NONE (GO)	D7 EGRS	FILL FORD	UET EGRS	RIBB S-R	MAB S-R	BAIL BRDG	RIBB B/R	MGB	MAB B/R	AVLB	NUGO
					VEHICLES AS-IS							
M151A2	0	95	5	0	0	0	0	0	0	0	0	0
M861	0	97	3	0	0	0	0	0	0	0	0	0
*M561	0	98	2	0	0	0	0	0	0	0	0	0
M35A2	0	98	2	0	0	0	0	0	0	0	0	0
M813	0	98	2	0	0	0	0	0	0	0	0	0
*M656	3	95	2	0	0	0	0	0	0	0	0	0
*M520E1	3	95	2	0	0	0	0	0	0	0	0	0
M125E1	0	98	2	0	0	0	0	0	0	0	0	0
M818/M125	0	98	2	0	0	0	0	0	0	0	0	0
TD901	8	91	2	0	0	0	0	0	0	0	0	0
M548E1**	47	51	1	0	0	0	0	0	0	0	0	0
ALL	6	92	2	0	0	0	0	0	0	0	0	0
					VEHICLES WITH DEEP FORDING							
M151A2	0	95	5	0	0	0	0	0	0	0	0	0
M861	0	97	3	0	0	0	0	0	0	0	0	0
*M561	0	98	2	0	0	0	0	0	0	0	0	0
M35A2	0	98	2	0	0	0	0	0	0	0	0	0
M813	0	98	2	0	0	0	0	0	0	0	0	0
*M656	3	95	2	0	0	0	0	0	0	0	0	0
*M520E1	3	95	2	0	0	0	0	0	0	0	0	0
M125E1	0	98	2	0	0	0	0	0	0	0	0	0
M818/M125	0	98	2	0	0	0	0	0	0	0	0	0
TD901	8	91	2	0	0	0	0	0	0	0	0	0
M548E1**	47	51	1	0	0	0	0	0	0	0	0	0
ALL	6	92	2	0	0	0	0	0	0	0	0	0
					VEHICLES FOR REFERENCE							
*M113A2	50	49	1	0	0	0	0	0	0	0	0	0
*XM723	74	25	1	0	0	0	0	0	0	0	0	0
*M551	64	34	1	0	0	0	0	0	0	0	0	0
M60A1	72	27	1	0	0	0	0	0	0	0	0	0
ALL	65	34	1	0	0	0	0	0	0	0	0	0

*SWIMMER
**DEEP FORDING AS-IS

TABLE E28

RELATIVE LEVEL OF ASSISTANCE LEVELS REQUIRED
WACROSS WEST GERMANY NORTH-SOUTH AXES

CORRIDOR WIDTH: 4.0 KM. AXIS LENGTH: 223.1 KM.
FLOW STAGE: HIGH

ASSIST REQD	PERCENT NONE (GO)	D7 EGRS	FILL FORD	WET EGRS	RIBB S-R	MAB S-R	BAIL BRDG	RIBB B/R	MGB	MAB B/R	AVLB	NOGO
VEHICLES AS-IS												
M151A2	0	76	24	0	0	0	0	0	0	0	0	0
M861	0	82	18	0	0	0	0	0	0	0	0	0
*M561	0	88	12	0	0	0	0	0	0	0	0	0
M35A2	0	89	11	0	0	0	0	0	0	0	0	0
M813	0	89	11	0	0	0	0	0	0	0	0	0
*M656	5	93	2	0	0	0	0	0	0	0	0	0
*M520E1	4	94	2	0	0	0	0	0	0	0	0	0
M125E1	0	89	11	0	0	0	0	0	0	0	0	0
M818/M125	0	89	11	0	0	0	0	0	0	0	0	0
TD901	0	93	7	0	0	0	0	0	0	0	0	0
M548E1**	56	44	0	0	0	0	0	0	0	0	0	0
ALL	6	84	10	0	0	0	0	0	0	0	0	0
VEHICLES WITH DEEP FORDING												
M151A2	0	76	24	0	0	0	0	0	0	0	0	0
M861	0	82	18	0	0	0	0	0	0	0	0	0
*M561	0	88	12	0	0	0	0	0	0	0	0	0
M35A2	0	88	12	0	0	0	0	0	0	0	0	0
M813	0	88	12	0	0	0	0	0	0	0	0	0
*M656	0	93	7	0	0	0	0	0	0	0	0	0
*M520E1	4	94	2	0	0	0	0	0	0	0	0	0
M125E1	0	93	7	0	0	0	0	0	0	0	0	0
M818/M125	0	93	7	0	0	0	0	0	0	0	0	0
TD901	0	98	2	0	0	0	0	0	0	0	0	0
M548E1**	56	44	0	0	0	0	0	0	0	0	0	0
ALL	5	85	9	0	0	0	0	0	0	0	0	0
VEHICLES FOR REFERENCE												
*M113A2	52	48	0	0	0	0	0	0	0	0	0	0
*XM723	73	27	0	0	0	0	0	0	0	0	0	0
*M551	67	33	0	0	0	0	0	0	0	0	0	0
M60A1	73	27	0	0	0	0	0	0	0	0	0	0
ALL	66	34	0	0	0	0	0	0	0	0	0	0

*SWIMMER
**DEEP FORDING AS-IS

TABLE E29

RELATIVE LEVEL OF ASSISTANCE LEVELS REQUIRED
WACROSS WEST GERMANY NORTH-SOUTH AXES

CORRIDOR WIDTH: 4.0 KM.   AXIS LENGTH: 223.1 KM.
FLOW STAGE: AVERAGE

ASSIST REQD	PERCENT NONE (GO)	D7 EGRS	FILL FORD	WET EGRS	RIBB S-R	MAB S-R	BAIL BRDG	RIBB B/R	MGB	MAB B/R	AVLB	NOGO
VEHICLES AS-IS												
M151A2	0	95	5	0	0	0	0	0	0	0	0	0
M861	0	98	2	0	0	0	0	0	0	0	0	0
*M561	0	100	0	0	0	0	0	0	0	0	0	0
M35A2	0	98	2	0	0	0	0	0	0	0	0	0
M813	0	98	2	0	0	0	0	0	0	0	0	0
*M656	0	100	0	0	0	0	0	0	0	0	0	0
*M520E1	7	93	0	0	0	0	0	0	0	0	0	0
M125E1	0	98	2	0	0	0	0	0	0	0	0	0
M818/M125	0	98	2	0	0	0	0	0	0	0	0	0
TD901	0	100	0	0	0	0	0	0	0	0	0	0
M548E1**	52	48	0	0	0	0	0	0	0	0	0	0
ALL	6	93	2	0	0	0	0	0	0	0	0	0
VEHICLES WITH DEEP FORDING												
M151A2	0	95	5	0	0	0	0	0	0	0	0	0
M861	0	98	2	0	0	0	0	0	0	0	0	0
*M561	0	100	0	0	0	0	0	0	0	0	0	0
M35A2	0	100	0	0	0	0	0	0	0	0	0	0
M813	0	100	0	0	0	0	0	0	0	0	0	0
*M656	0	100	0	0	0	0	0	0	0	0	0	0
*M520E1	7	93	0	0	0	0	0	0	0	0	0	0
M125E1	0	100	0	0	0	0	0	0	0	0	0	0
M818/M125	0	100	0	0	0	0	0	0	0	0	0	0
TD901	0	100	0	0	0	0	0	0	0	0	0	0
M548E1**	52	48	0	0	0	0	0	0	0	0	0	0
ALL	6	94	1	0	0	0	0	0	0	0	0	0
VEHICLES FOR REFERENCE												
*M113A2	52	48	0	0	0	0	0	0	0	0	0	0
*XM723	73	27	0	0	0	0	0	0	0	0	0	0
*M551	61	39	0	0	0	0	0	0	0	0	0	0
M60A1	73	27	0	0	0	0	0	0	0	0	0	0
ALL	65	35	0	0	0	0	0	0	0	0	0	0

*SWIMMER
**DEEP FORDING AS-IS

TABLE E30

RELATIVE LEVEL OF ASSISTANCE LEVELS REQUIRED
WACROSS WEST GERMANY NORTH-SOUTH AXES

CORRIDOR WIDTH: 4.0 KM. AXIS LENGTH: 223.1 KM.
FLOW STAGE: LOW

ASSIST REQD	PERCENT NONE (GO)	D7 EGRS	FILL FORD	UEI EGRS	RIBB S-R	MAB S-R	BAIL BRDG	RIBB B/R	MGB	MAB B/R	AVLB	NOGO
VEHICLES AS-IS												
M151A2	0	100	0	0	0	0	0	0	0	0	0	0
M861	0	100	0	0	0	0	0	0	0	0	0	0
*M561	0	100	0	0	0	0	0	0	0	0	0	0
M35A2	0	100	0	0	0	0	0	0	0	0	0	0
M813	0	100	0	0	0	0	0	0	0	0	0	0
*M656	0	100	0	0	0	0	0	0	0	0	0	0
*M520E1	0	100	0	0	0	0	0	0	0	0	0	0
M125E1	0	100	0	0	0	0	0	0	0	0	0	0
M818/M125	0	100	0	0	0	0	0	0	0	0	0	0
TD901	5	95	0	0	0	0	0	0	0	0	0	0
M548E1**	70	30	0	0	0	0	0	0	0	0	0	0
ALL	8	92	0	0	0	0	0	0	0	0	0	0
VEHICLES WITH DEEP FORDING												
M151A2	0	100	0	0	0	0	0	0	0	0	0	0
M861	0	100	0	0	0	0	0	0	0	0	0	0
*M561	0	100	0	0	0	0	0	0	0	0	0	0
M35A2	0	100	0	0	0	0	0	0	0	0	0	0
M813	0	100	0	0	0	0	0	0	0	0	0	0
*M656	0	100	0	0	0	0	0	0	0	0	0	0
*M520E1	0	100	0	0	0	0	0	0	0	0	0	0
M125E1	0	100	0	0	0	0	0	0	0	0	0	0
M818/M125	0	100	0	0	0	0	0	0	0	0	0	0
TD901	5	95	0	0	0	0	0	0	0	0	0	0
M548E1**	70	30	0	0	0	0	0	0	0	0	0	0
ALL	8	92	0	0	0	0	0	0	0	0	0	0
VEHICLES FOR REFERENCE												
*M113A2	72	28	0	0	0	0	0	0	0	0	0	0
*XM723	84	16	0	0	0	0	0	0	0	0	0	0
*M551	79	21	0	0	0	0	0	0	0	0	0	0
M60A1	84	16	0	0	0	0	0	0	0	0	0	0
ALL	80	20	0	0	0	0	0	0	0	0	0	0

*SWIMMER
**DEEP FORDING AS-IS

TABLE E31

RELATIVE LEVEL OF ASSISTANCE LEVELS REQUIRED
WACROSS WEST GERMANY ALL AXIS

CORRIDOR WIDTH: 1.0 KM. AXIS LENGTH: 431.2 KM.
FLOW STAGE: HIGH

ASSIST REQD	PERCENT NONE (GO)	D7 EGRS	FILL FORD	WET EGRS	RIBB S-R	MAB S-R	BAIL BRDG	RIBB B/R	MGB	MAB B/R	AVLB	NOGO
VEHICLES AS-IS												
M151A2	0	78	17	0	0	0	4	0	0	0	0	0
M861	0	82	14	0	0	0	4	0	0	0	0	0
*M561	0	91	5	0	0	0	4	0	0	0	0	0
M35A2	0	89	7	0	0	0	4	0	0	0	0	0
M813	0	89	7	0	0	0	4	0	0	0	0	0
*M656	1	93	2	0	0	0	4	0	0	0	0	0
*M520E1	7	86	3	1	0	0	4	0	0	0	0	0
M125E1	0	89	7	0	0	0	4	0	0	0	0	0
M818/M125	0	89	7	0	0	0	4	0	0	0	0	0
TD901	1	93	3	0	0	0	4	0	0	0	0	0
M548E1**	40	58	1	0	0	0	1	0	0	0	0	0
ALL	4	85	7	0	0	0	4	0	0	0	0	0
VEHICLES WITH DEEP FORDING												
M151A2	0	78	17	0	0	0	4	0	0	0	0	0
M861	0	82	14	0	0	0	4	0	0	0	0	0
*M561	0	90	6	0	0	0	4	0	0	0	0	0
M35A2	0	92	4	0	0	0	4	0	0	0	0	0
M813	0	92	4	0	0	0	4	0	0	0	0	0
*M656	0	93	3	0	0	0	4	0	0	0	0	0
*M520E1	7	86	3	1	0	0	4	0	0	0	0	0
M125E1	0	94	3	1	0	0	3	0	0	0	0	0
M818/M125	0	93	3	1	0	0	3	0	0	0	0	0
TD901	1	95	2	1	0	0	2	0	0	0	0	0
M548E1**	40	58	1	0	0	0	1	0	0	0	0	0
ALL	4	87	5	0	0	0	3	0	0	0	0	0
VEHICLES FOR REFERENCE												
*M113A2	38	59	1	1	0	0	2	0	0	0	0	0
*XM723	71	26	1	0	0	0	2	0	0	0	0	0
*M551	58	39	1	1	0	0	2	0	0	0	0	0
M60A1	62	32	4	0	0	0	2	0	0	0	0	0
ALL	57	39	2	0	0	0	2	0	0	0	0	0

*SWIMMER
**DEEP FORDING AS-IS

TABLE E32

RELATIVE LEVEL OF ASSISTANCE LEVELS REQUIRED
WACROSS WEST GERMANY ALL AXIS

CORRIDOR WIDTH: 1.0 KM. AXIS LENGTH: 431.2 KM.
FLOW STAGE: AVERAGE

ASSIST REQD	PERCENT NONE (GO)	D7 EGRS	FILL FORD	WET EGRS	RIBB S-R	MAB S-R	BAIL BRDG	RIBB B/R	MGB	MAB B/R	AVLB	NUGO
VEHICLES AS-IS												
M151A2	0	93	5	0	0	0	2	0	0	0	0	0
M861	0	94	4	0	0	0	2	0	0	0	0	0
*M561	0	96	4	0	0	0	0	0	0	0	0	0
M35A2	0	94	4	0	0	0	2	0	0	0	0	0
M813	0	94	4	0	0	0	2	0	0	0	0	0
*M656	1	96	4	0	0	0	0	0	0	0	0	0
*M520E1	7	89	4	0	0	0	0	0	0	0	0	0
M125E1	0	94	4	0	0	0	2	0	0	0	0	0
M818/M125	0	94	4	0	0	0	2	0	0	0	0	0
TD901	1	96	4	0	0	0	0	0	0	0	0	0
M548E1**	36	61	3	0	0	0	0	0	0	0	0	0
ALL	4	91	4	0	0	0	1	0	0	0	0	0
VEHICLES WITH DEEP FORDING												
M151A2	0	93	5	0	0	0	2	0	0	0	0	0
M861	0	94	4	0	0	0	2	0	0	0	0	0
*M561	0	96	4	0	0	0	0	0	0	0	0	0
M35A2	0	96	4	0	0	0	0	0	0	0	0	0
M813	0	96	4	0	0	0	0	0	0	0	0	0
*M656	1	96	4	0	0	0	0	0	0	0	0	0
*M520E1	7	89	4	0	0	0	0	0	0	0	0	0
M125E1	0	96	4	0	0	0	0	0	0	0	0	0
M818/M125	0	96	4	0	0	0	0	0	0	0	0	0
TD901	1	96	4	0	0	0	0	0	0	0	0	0
M548E1**	36	61	3	0	0	0	0	0	0	0	0	0
ALL	4	92	4	0	0	0	0	0	0	0	0	0
VEHICLES FOR REFERENCE												
*M113A2	37	60	3	0	0	0	0	0	0	0	0	0
*XM723	74	22	3	0	0	0	0	0	0	0	0	0
*M551	49	47	4	0	0	0	0	0	0	0	0	0
M60A1	65	32	3	0	0	0	0	0	0	0	0	0
ALL	56	41	3	0	0	0	0	0	0	0	0	0

*SWIMMER
**DEEP FORDING AS-IS

TABLE E33

RELATIVE LEVEL OF ASSISTANCE LEVELS REQUIRED
WACROSS WEST GERMANY ALL AXIS

CORRIDOR WIDTH: 1.0 KM. AXIS LENGTH: 431.2 KM.
FLOW STAGE: LOW

ASSIST REQD	PERCENT NONE (GO)	D7 EGRS	FILL FORD	UEI EGRS	RIBB S-R	MAB S-R	BAIL BRDG	RIBB B/R	MGB	MAB B/R	AVLB	NOGO
VEHICLES AS-IS												
M151A2	0	97	3	0	0	0	1	0	0	0	0	0
M861	0	97	3	0	0	0	1	0	0	0	0	0
*M561	0	97	2	0	0	0	1	0	0	0	0	0
M35A2	1	97	2	0	0	0	1	0	0	0	0	0
M813	0	97	2	0	0	0	1	0	0	0	0	0
*M656	6	92	2	0	0	0	1	0	0	0	0	0
*M520E1	4	94	2	0	0	0	1	0	0	0	0	0
M125E1	0	97	2	0	0	0	1	0	0	0	0	0
M818/M125	0	97	2	0	0	0	1	0	0	0	0	0
TD901	4	94	2	0	0	0	1	0	0	0	0	0
M548E1**	40	58	2	0	0	0	1	0	0	0	0	0
ALL	5	93	2	0	0	0	1	0	0	0	0	0
VEHICLES WITH DEEP FORDING												
M151A2	0	97	3	0	0	0	1	0	0	0	0	0
M861	0	97	3	0	0	0	1	0	0	0	0	0
*M561	0	97	2	0	0	0	1	0	0	0	0	0
M35A2	1	97	2	0	0	0	1	0	0	0	0	0
M813	0	98	2	0	0	0	1	0	0	0	0	0
*M656	6	92	2	0	0	0	1	0	0	0	0	0
*M520E1	4	94	2	0	0	0	1	0	0	0	0	0
M125E1	0	98	2	0	0	0	1	0	0	0	0	0
M818/M125	0	98	2	0	0	0	1	0	0	0	0	0
TD901	4	94	2	0	0	0	1	0	0	0	0	0
M548E1**	40	58	2	0	0	0	1	0	0	0	0	0
ALL	5	93	2	0	0	0	1	0	0	0	0	0
VEHICLES FOR REFERENCE												
*M113A2	41	56	2	0	0	0	1	0	0	0	0	0
*XM723	77	21	2	0	0	0	1	0	0	0	0	0
*M551	54	44	2	0	0	0	1	0	0	0	0	0
M60A1	68	30	2	0	0	0	1	0	0	0	0	0
ALL	60	38	2	0	0	0	1	0	0	0	0	0

*SWIMMER
**DEEP FORDING AS-IS

TABLE E34

RELATIVE LEVEL OF ASSISTANCE LEVELS REQUIRED
WACROSS WEST GERMANY ALL AXIS

CORRIDOR WIDTH: 2.0 KM. AXIS LENGTH: 431.2 KM.
FLOW STAGE: HIGH

ASSIST REQD	PERCENT NONE (GO)	D7 EGRS	FILL FORD	UET EGRS	RIBB S-R	MAB S-R	BAIL BRDG	RIBB B/R	MGB	MAB B/R	AVLB	NOGO
VEHICLES AS-IS												
M151A2	0	79	19	0	0	0	1	0	0	0	0	0
M861	0	84	15	0	0	0	2	0	0	0	0	0
*M561	0	92	6	0	0	0	2	0	0	0	0	0
M35A2	0	91	7	0	0	0	2	0	0	0	0	0
M813	0	91	7	0	0	0	2	0	0	0	0	0
*M656	1	95	2	0	0	0	2	0	0	0	0	0
*M520E1	8	86	5	0	0	0	2	0	0	0	0	0
M125E1	0	91	7	0	0	0	2	0	0	0	0	0
M818/M125	0	91	7	0	0	0	2	0	0	0	0	0
TD901	0	95	3	0	0	0	2	0	0	0	0	0
M548E1**	39	61	0	0	0	0	1	0	0	0	0	0
ALL	4	87	7	0	0	0	1	0	0	0	0	0
VEHICLES WITH DEEP FORDING												
M151A2	0	79	19	0	0	0	1	0	0	0	0	0
M861	0	84	15	0	0	0	2	0	0	0	0	0
*M561	0	91	7	0	0	0	2	0	0	0	0	0
M35A2	0	92	6	0	0	0	2	0	0	0	0	0
M813	0	93	6	0	0	0	2	0	0	0	0	0
*M656	0	95	3	0	0	0	2	0	0	0	0	0
*M520E1	8	87	4	0	0	0	2	0	0	0	0	0
M125E1	0	94	4	1	0	0	2	0	0	0	0	0
M818/M125	0	94	4	0	0	0	2	0	0	0	0	0
TD901	0	97	2	0	0	0	2	0	0	0	0	0
M548E1**	39	61	0	0	0	0	1	0	0	0	0	0
ALL	4	88	6	0	0	0	1	0	0	0	0	0
VEHICLES FOR REFERENCE												
*M113A2	38	61	0	0	0	0	1	0	0	0	0	0
*XM723	73	26	1	0	0	0	1	0	0	0	0	0
*M551	66	32	1	0	0	0	1	0	0	0	0	0
M60A1	69	28	2	0	0	0	1	0	0	0	0	0
ALL	62	36	1	0	0	0	1	0	0	0	0	0

*SWIMMER
**DEEP FORDING AS-IS

TABLE E35

RELATIVE LEVEL OF ASSISTANCE LEVELS REQUIRED
WACROSS WEST GERMANY ALL AXIS

CORRIDOR WIDTH: 2.0 KM. AXIS LENGTH: 431.2 KM.
FLOW STAGE: AVERAGE

ASSIST REQD	PERCENT NONE (GO)	D7 EGRS	FILL FORD	WET EGRS	RIBB S-R	MAB S-R	BAIL BRDG	RIBB B/R	MGB	MAB B/R	AVLB	NOGO
VEHICLES AS-IS												
M151A2	0	92	8	0	0	0	0	0	0	0	0	0
M861	0	93	7	0	0	0	0	0	0	0	0	0
*M561	0	94	6	0	0	0	0	0	0	0	0	0
M35A2	0	93	7	0	0	0	0	0	0	0	0	0
M813	0	93	7	0	0	0	0	0	0	0	0	0
*M656	1	95	4	0	0	0	0	0	0	0	0	0
*M520E1	9	87	4	0	0	0	0	0	0	0	0	0
M125E1	0	93	7	0	0	0	0	0	0	0	0	0
M818/M125	0	93	7	0	0	0	0	0	0	0	0	0
TD901	0	96	4	0	0	0	0	0	0	0	0	0
M548E1**	38	59	3	0	0	0	0	0	0	0	0	0
ALL	5	90	6	0	0	0	0	0	0	0	0	0
VEHICLES WITH DEEP FORDING												
M151A2	0	92	8	0	0	0	0	0	0	0	0	0
M861	0	93	7	0	0	0	0	0	0	0	0	0
*M561	0	94	6	0	0	0	0	0	0	0	0	0
M35A2	0	96	4	0	0	0	0	0	0	0	0	0
M813	0	96	4	0	0	0	0	0	0	0	0	0
*M656	1	95	4	0	0	0	0	0	0	0	0	0
*M520E1	9	87	4	0	0	0	0	0	0	0	0	0
M125E1	0	96	4	0	0	0	0	0	0	0	0	0
M818/M125	0	96	4	0	0	0	0	0	0	0	0	0
TD901	0	96	4	0	0	0	0	0	0	0	0	0
M548E1**	38	59	3	0	0	0	0	0	0	0	0	0
ALL	5	91	5	0	0	0	0	0	0	0	0	0
VEHICLES FOR REFERENCE												
*M113A2	38	58	3	0	0	0	0	0	0	0	0	0
*XM723	73	24	3	0	0	0	0	0	0	0	0	0
*M551	57	40	3	0	0	0	0	0	0	0	0	0
M60A1	69	28	3	0	0	0	0	0	0	0	0	0
ALL	59	38	3	0	0	0	0	0	0	0	0	0

*SWIMMER
**DEEP FORDING AS-IS

TABLE E36

RELATIVE LEVEL OF ASSISTANCE LEVELS REQUIRED
WACROSS WEST GERMANY ALL AXIS

CORRIDOR WIDTH: 2.0 KM. AXIS LENGTH: 431.2 KM.
FLOW STAGE: LOW

VEHICLES AS-IS

ASSIST REQD	PERCENT NONE (GO)	D7 EGRS	FILL FORD	WET EGRS	RIBB S-R	MAB S-R	BAIL BRDG	RIBB B/R	MGB	MAB H/R	AVLB	NOGO
M151A2	0	97	3	0	0	0	0	0	0	0	0	0
M861	0	98	2	0	0	0	0	0	0	0	0	0
*M561	0	99	1	0	0	0	0	0	0	0	0	0
M35A2	0	99	1	0	0	0	0	0	0	0	0	0
M813	0	99	1	0	0	0	0	0	0	0	0	0
*M656	3	96	1	0	0	0	0	0	0	0	0	0
*M520E1	2	97	1	0	0	0	0	0	0	0	0	0
M125E1	0	99	1	0	0	0	0	0	0	0	0	0
M818/M125	0	99	1	0	0	0	0	0	0	0	0	0
TD901	8	92	1	0	0	0	0	0	0	0	0	0
M548E1**	43	56	1	0	0	0	0	0	0	0	0	0
ALL	5	94	1	0	0	0	0	0	0	0	0	0

VEHICLES WITH DEEP FORDING

ASSIST REQD	PERCENT NONE (GO)	D7 EGRS	FILL FORD	WET EGRS	RIBB S-R	MAB S-R	BAIL BRDG	RIBB B/R	MGB	MAB H/R	AVLB	NOGO
M151A2	0	97	3	0	0	0	0	0	0	0	0	0
M861	0	98	2	0	0	0	0	0	0	0	0	0
*M561	0	99	1	0	0	0	0	0	0	0	0	0
M35A2	0	99	1	0	0	0	0	0	0	0	0	0
M813	0	99	1	0	0	0	0	0	0	0	0	0
*M656	3	96	1	0	0	0	0	0	0	0	0	0
*M520E1	2	97	1	0	0	0	0	0	0	0	0	0
M125E1	0	99	1	0	0	0	0	0	0	0	0	0
M818/M125	0	99	1	0	0	0	0	0	0	0	0	0
TD901	8	92	1	0	0	0	0	0	0	0	0	0
M548E1**	43	56	1	0	0	0	0	0	0	0	0	0
ALL	5	94	1	0	0	0	0	0	0	0	0	0

VEHICLES FOR REFERENCE

ASSIST REQD	PERCENT NONE (GO)	D7 EGRS	FILL FORD	WET EGRS	RIBB S-R	MAB S-R	BAIL BRDG	RIBB B/R	MGB	MAB H/R	AVLB	NOGO
*M113A2	46	53	1	0	0	0	0	0	0	0	0	0
*XM723	75	24	1	0	0	0	0	0	0	0	0	0
*M551	64	35	1	0	0	0	0	0	0	0	0	0
M60A1	73	26	1	0	0	0	0	0	0	0	0	0
ALL	65	34	1	0	0	0	0	0	0	0	0	0

*SWIMMER
**DEEP FORDING AS-IS

TABLE E37

RELATIVE LEVEL OF ASSISTANCE LEVELS REQUIRED
WACROSS WEST GERMANY ALL AXIS

CORRIDOR WIDTH: 4.0 KM. AXIS LENGTH: 431.2 KM.
FLOW STAGE: HIGH

ASSIST REQD	PERCENT NONE (GO)	D7 EGRS	FILL FORD	UET EGRS	RIBB S-R	MAB S-R	BAIL BRDG	RIBB B/R	MGB	MAB B/R	AVLB	NOGO
VEHICLES AS-IS												
M151A2	0	77	22	0	0	0	1	0	0	0	0	0
M861	0	83	16	0	0	0	1	0	0	0	0	0
*M561	0	90	9	0	0	0	1	0	0	0	0	0
M35A2	0	90	9	0	0	0	1	0	0	0	0	0
M813	0	90	9	0	0	0	1	0	0	0	0	0
*M656	2	93	4	0	0	0	1	0	0	0	0	0
*M520E1	2	93	4	0	0	0	1	0	0	0	0	0
M125E1	0	90	9	0	0	0	1	0	0	0	0	0
M818/M125	0	90	9	0	0	0	1	0	0	0	0	0
TD901	0	93	6	0	0	0	1	0	0	0	0	0
M548E1**	54	46	0	0	0	0	0	0	0	0	0	0
ALL	5	85	9	0	0	0	1	0	0	0	0	0
VEHICLES WITH DEEP FORDING												
M151A2	0	77	22	0	0	0	1	0	0	0	0	0
M861	0	83	16	0	0	0	1	0	0	0	0	0
*M561	0	90	9	0	0	0	1	0	0	0	0	0
M35A2	0	90	9	0	0	0	1	0	0	0	0	0
M813	0	89	9	0	0	0	1	0	0	0	0	0
*M656	0	93	6	0	0	0	1	0	0	0	0	0
*M520E1	2	94	3	0	0	0	1	0	0	0	0	0
M125E1	0	92	7	1	0	0	0	0	0	0	0	0
M818/M125	0	92	7	1	0	0	0	0	0	0	0	0
TD901	0	95	3	1	0	0	0	0	0	0	0	0
M548E1**	54	46	0	0	0	0	0	0	0	0	0	0
ALL	5	85	8	0	0	0	1	0	0	0	0	0
VEHICLES FOR REFERENCE												
*M113A2	50	50	0	0	0	0	0	0	0	0	0	0
*XM723	76	24	0	0	0	0	0	0	0	0	0	0
*M551	66	34	0	0	0	0	0	0	0	0	0	0
M60A1	70	30	0	0	0	0	0	0	0	0	0	0
ALL	65	35	0	0	0	0	0	0	0	0	0	0

*SWIMMER
**DEEP FORDING AS-IS

TABLE E38

RELATIVE LEVEL OF ASSISTANCE LEVELS REQUIRED
WACROSS WEST GERMANY ALL AXIS

CORRIDOR WIDTH: 4.0 KM. AXIS LENGTH: 431.2 KM.
FLOW STAGE: AVERAGE

ASSIST REQD	PERCENT NONE (GO)	D7 EGRS	FILL FORD	UET EGRS	RIBB S-R	MAB S-R	BAIL BRDG	RIBB B/R	MGB	MAB B/R	AVLB	NOGO
				VEHICLES AS-IS								
M151A2	0	92	8	0	0	0	0	0	0	0	0	0
M861	0	93	7	0	0	0	0	0	0	0	0	0
*M561	0	95	5	0	0	0	0	0	0	0	0	0
M35A2	0	93	7	0	0	0	0	0	0	0	0	0
M813	0	93	7	0	0	0	0	0	0	0	0	0
*M656	1	96	2	0	0	0	0	0	0	0	0	0
*M520E1	5	93	2	0	0	0	0	0	0	0	0	0
M125E1	0	93	7	0	0	0	0	0	0	0	0	0
M818/M125	0	93	7	0	0	0	0	0	0	0	0	0
TD901	0	98	2	0	0	0	0	0	0	0	0	0
M548E1**	52	46	2	0	0	0	0	0	0	0	0	0
ALL	6	89	5	0	0	0	0	0	0	0	0	0
				VEHICLES WITH DEEP FORDING								
M151A2	0	92	8	0	0	0	0	0	0	0	0	0
M861	0	93	7	0	0	0	0	0	0	0	0	0
*M561	0	95	5	0	0	0	0	0	0	0	0	0
M35A2	1	96	2	0	0	0	0	0	0	0	0	0
M813	0	98	2	0	0	0	0	0	0	0	0	0
*M656	1	96	2	0	0	0	0	0	0	0	0	0
*M520E1	5	93	2	0	0	0	0	0	0	0	0	0
M125E1	0	98	2	0	0	0	0	0	0	0	0	0
M818/M125	0	98	2	0	0	0	0	0	0	0	0	0
TD901	0	98	2	0	0	0	0	0	0	0	0	0
M548E1**	52	46	2	0	0	0	0	0	0	0	0	0
ALL	6	91	4	0	0	0	0	0	0	0	0	0
				VEHICLES FOR REFERENCE								
*M113A2	50	48	2	0	0	0	0	0	0	0	0	0
*XM723	77	20	2	0	0	0	0	0	0	0	0	0
*M551	63	35	2	0	0	0	0	0	0	0	0	0
M60A1	73	25	2	0	0	0	0	0	0	0	0	0
ALL	65	32	2	0	0	0	0	0	0	0	0	0

*SWIMMER
**DEEP FORDING AS-IS

TABLE E39

RELATIVE LEVEL OF ASSISTANCE LEVELS REQUIRED
WACROSS WEST GERMANY ALL AXIS

CORRIDOR WIDTH: 4.0 KM. AXIS LENGTH: 431.2 KM.
FLOW STAGE: LOW

ASSIST REQD	PERCENT NONE (GO)	D7 EGRS	FILL FORD	UEI EGRS	RIBB S-R	MAB S-R	BAIL BRDG	RIBB B/R	MGB	MAB B/R	AVLB	NOGO
VEHICLES AS-IS												
M151A2	0	100	0	0	0	0	0	0	0	0	0	0
M861	0	100	0	0	0	0	0	0	0	0	0	0
*M561	0	100	0	0	0	0	0	0	0	0	0	0
M35A2	1	99	0	0	0	0	0	0	0	0	0	0
M813	0	100	0	0	0	0	0	0	0	0	0	0
*M656	1	99	0	0	0	0	0	0	0	0	0	0
*M520E1	1	99	0	0	0	0	0	0	0	0	0	0
M125E1	0	100	0	0	0	0	0	0	0	0	0	0
M818/M125	0	100	0	0	0	0	0	0	0	0	0	0
TD901	9	91	0	0	0	0	0	0	0	0	0	0
M548E1**	66	34	0	0	0	0	0	0	0	0	0	0
ALL	8	92	0	0	0	0	0	0	0	0	0	0
VEHICLES WITH DEEP FORDING												
M151A2	0	100	0	0	0	0	0	0	0	0	0	0
M861	0	100	0	0	0	0	0	0	0	0	0	0
*M561	0	100	0	0	0	0	0	0	0	0	0	0
M35A2	1	99	0	0	0	0	0	0	0	0	0	0
M813	0	100	0	0	0	0	0	0	0	0	0	0
*M656	1	99	0	0	0	0	0	0	0	0	0	0
*M520E1	1	99	0	0	0	0	0	0	0	0	0	0
M125E1	0	100	0	0	0	0	0	0	0	0	0	0
M818/M125	0	100	0	0	0	0	0	0	0	0	0	0
TD901	9	91	0	0	0	0	0	0	0	0	0	0
M548E1**	66	34	0	0	0	0	0	0	0	0	0	0
ALL	8	92	0	0	0	0	0	0	0	0	0	0
VEHICLES FOR REFERENCE												
*M113A2	68	32	0	0	0	0	0	0	0	0	0	0
*XM723	85	15	0	0	0	0	0	0	0	0	0	0
*M551	79	21	0	0	0	0	0	0	0	0	0	0
M60A1	83	17	0	0	0	0	0	0	0	0	0	0
ALL	79	21	0	0	0	0	0	0	0	0	0	0

*SWIMMER
**DEEP FORDING AS-IS

APPENDIX F: DATA SHOWING WATER STAGE EFFECTS ON RESULTS, MID-EAST STUDY AREA

Tables 19 through 21 of the main text present breakdowns of required assistance methods combined for high and low water stages in the Mid-East study area. Tables F1 through F6 give the same information for the two stages separately.

TABLE F1

RELATIVE LEVEL OF ASSISTANCE LEVELS REQUIRED
WACROSS MID EAST AREA SOUTH-NORTH AXES

CORRIDOR WIDTH: 1.0 KM AXIS LENGTH: 348.6 KM
FLOW STAGE: HIGH

ASSIST REQD	PERCENT NONE (GO)	D7 EGRS	FILL FORD	UET EGRS	RIBB S-R	MAB S-R	BAIL BRDG	RIBB B/R	MGB	MAB H/R	AVLB	NOGO
VEHICLES AS-IS												
M151A2	93	4	3	0	0	0	0	0	0	0	0	0
M861	79	18	3	0	0	0	0	0	0	0	0	0
*M561	96	2	2	0	0	0	0	0	0	0	0	0
M35A2	96	2	2	0	0	0	0	0	0	0	0	0
M813	92	6	2	0	0	0	0	0	0	0	0	0
*M656	96	2	2	0	0	0	0	0	0	0	0	0
*M520E1	96	2	2	0	0	0	0	0	0	0	0	0
M125E1	93	6	2	0	0	0	0	0	0	0	0	0
M818/M125	92	6	2	0	0	0	0	0	0	0	0	0
TD901	94	5	2	0	0	0	0	0	0	0	0	0
M548E1**	96	4	0	0	0	0	0	0	0	0	0	0
ALL	93	5	2	0	0	0	0	0	0	0	0	0
VEHICLES WITH DEEP FORDING												
M151A2	93	4	3	0	0	0	0	0	0	0	0	0
M861	79	18	3	0	0	0	0	0	0	0	0	0
*M561	96	2	2	0	0	0	0	0	0	0	0	0
M35A2	96	2	2	0	0	0	0	0	0	0	0	0
M813	93	6	2	0	0	0	0	0	0	0	0	0
*M656	96	2	2	0	0	0	0	0	0	0	0	0
*M520E1	97	2	1	0	0	0	0	0	0	0	0	0
M125E1	94	5	1	0	0	0	0	0	0	0	0	0
M818/M125	93	6	1	0	0	0	0	0	0	0	0	0
TD901	94	5	1	0	0	0	0	0	0	0	0	0
M548E1**	96	4	0	0	0	0	0	0	0	0	0	0
ALL	94	5	1	0	0	0	0	0	0	0	0	0
VEHICLES FOR REFERENCE												
*M113A2	97	3	0	0	0	0	0	0	0	0	0	0
*XM723	98	0	2	0	0	0	0	0	0	0	0	0
*M551	96	3	2	0	0	0	0	0	0	0	0	0
M60A1	97	1	2	0	0	0	0	0	0	0	0	0
ALL	97	2	1	0	0	0	0	0	0	0	0	0

*SWIMMER
**DEEP FORDING AS-IS

TABLE F2

RELATIVE LEVEL OF ASSISTANCE LEVELS REQUIRED
WACROSS MID-EAST AREA SOUTH-NORTH AXES

CORRIDOR WIDTH: 1.0 KM AXIS LENGTH: 348.6 KM
FLOW STAGE: LOW

ASSIST REQD	PERCENT NONE (GO)	D7 EGRS	FILL FORD	UET EGRS	RIBB S-R	MAB S-R	BAIL BRDG	RIBB B/R	MGB	MAB B/R	AVLB	NOGO
VEHICLES AS-IS												
M151A2	96	4	0	0	0	0	0	0	0	0	0	0
M861	81	19	0	0	0	0	0	0	0	0	0	0
*M561	98	2	0	0	0	0	0	0	0	0	0	0
M35A2	98	2	0	0	0	0	0	0	0	0	0	0
M813	94	6	0	0	0	0	0	0	0	0	0	0
*M656	98	2	0	0	0	0	0	0	0	0	0	0
*M520E1	98	2	0	0	0	0	0	0	0	0	0	0
M125E1	95	5	0	0	0	0	0	0	0	0	0	0
M818/M125	94	6	0	0	0	0	0	0	0	0	0	0
TD901	95	5	0	0	0	0	0	0	0	0	0	0
M548E1**	96	4	0	0	0	0	0	0	0	0	0	0
ALL	95	5	0	0	0	0	0	0	0	0	0	0
VEHICLES WITH DEEP FORDING												
M151A2	96	4	0	0	0	0	0	0	0	0	0	0
M861	81	19	0	0	0	0	0	0	0	0	0	0
*M561	98	2	0	0	0	0	0	0	0	0	0	0
M35A2	98	2	0	0	0	0	0	0	0	0	0	0
M813	94	6	0	0	0	0	0	0	0	0	0	0
*M656	98	2	0	0	0	0	0	0	0	0	0	0
*M520E1	98	2	0	0	0	0	0	0	0	0	0	0
M125E1	95	5	0	0	0	0	0	0	0	0	0	0
M818/M125	94	6	0	0	0	0	0	0	0	0	0	0
TD901	95	5	0	0	0	0	0	0	0	0	0	0
M548E1**	96	4	0	0	0	0	0	0	0	0	0	0
ALL	95	5	0	0	0	0	0	0	0	0	0	0
VEHICLES FOR REFERENCE												
*M113A2	97	3	0	0	0	0	0	0	0	0	0	0
*XM723	100	0	0	0	0	0	0	0	0	0	0	0
*M551	97	3	0	0	0	0	0	0	0	0	0	0
M60A1	99	1	0	0	0	0	0	0	0	0	0	0
ALL	98	2	0	0	0	0	0	0	0	0	0	0

*SWIMMER
**DEEP FORDING AS-IS

TABLE F3

RELATIVE LEVEL OF ASSISTANCE LEVELS REQUIRED
WACROSS MID EAST AREA SOUTH-NORTH AXES

CORRIDOR WIDTH: 2.0 KM   AXIS LENGTH: 348.6 KM
FLOW STAGE: HIGH

ASSIST REQD	PERCENT NONE (GO)	D7 EGRS	FILL FORD	UET EGRS	RIBB S-R	MAB S-R	BAIL BRDG	RIBB B/R	MGB	MAB B/R	AVLB	NOGO
VEHICLES AS-IS												
M151A2	97	2	2	0	0	0	0	0	0	0	0	0
M861	84	16	0	0	0	0	0	0	0	0	0	0
*M561	99	1	0	0	0	0	0	0	0	0	0	0
M35A2	99	1	0	0	0	0	0	0	0	0	0	0
M813	93	7	0	0	0	0	0	0	0	0	0	0
*M656	99	1	0	0	0	0	0	0	0	0	0	0
*M520E1	99	1	0	0	0	0	0	0	0	0	0	0
M125E1	98	2	0	0	0	0	0	0	0	0	0	0
M818/M125	93	7	0	0	0	0	0	0	0	0	0	0
TD901	99	1	0	0	0	0	0	0	0	0	0	0
M548E1**	98	2	0	0	0	0	0	0	0	0	0	0
ALL	96	4	0	0	0	0	0	0	0	0	0	0
VEHICLES WITH DEEP FORDING												
M151A2	97	1	1	0	0	0	0	0	0	0	0	0
M861	84	16	0	0	0	0	0	0	0	0	0	0
*M561	99	1	0	0	0	0	0	0	0	0	0	0
M35A2	99	1	0	0	0	0	0	0	0	0	0	0
M813	93	7	0	0	0	0	0	0	0	0	0	0
*M656	99	1	0	0	0	0	0	0	0	0	0	0
*M520E1	100	0	0	0	0	0	0	0	0	0	0	0
M125E1	98	2	0	0	0	0	0	0	0	0	0	0
M818/M125	95	5	0	0	0	0	0	0	0	0	0	0
TD901	99	1	0	0	0	0	0	0	0	0	0	0
M548E1**	98	2	0	0	0	0	0	0	0	0	0	0
ALL	97	3	0	0	0	0	0	0	0	0	0	0
VEHICLES FOR REFERENCE												
*M113A2	99	1	0	0	0	0	0	0	0	0	0	0
*XM723	98	0	2	0	0	0	0	0	0	0	0	0
*M551	99	1	0	0	0	0	0	0	0	0	0	0
M60A1	98	2	0	0	0	0	0	0	0	0	0	0
ALL	99	1	0	0	0	0	0	0	0	0	0	0

*SWIMMER
**DEEP FORDING AS-IS

TABLE F4

RELATIVE LEVEL OF ASSISTANCE LEVELS REQUIRED
WACROSS MID EAST AREA SOUTH-NORTH AXES

CORRIDOR WIDTH: 2.0 KM AXIS LENGTH: 348.6 KM
FLOW STAGE: LOW

ASSIST REQD	PERCENT NONE (GO)	D7 EGRS	FILL FORD	UET EGRS	RIBB S-R	MAB S-R	BAIL BRDG	RIBB B/R	MGB	MAB B/R	AVLB	NOGO
VEHICLES AS-IS												
M151A2	98	2	0	0	0	0	0	0	0	0	0	0
M861	89	11	0	0	0	0	0	0	0	0	0	0
*M561	100	0	0	0	0	0	0	0	0	0	0	0
M35A2	100	0	0	0	0	0	0	0	0	0	0	0
M813	96	4	0	0	0	0	0	0	0	0	0	0
*M656	100	0	0	0	0	0	0	0	0	0	0	0
*M520E1	100	0	0	0	0	0	0	0	0	0	0	0
M125E1	98	2	0	0	0	0	0	0	0	0	0	0
M818/M125	96	4	0	0	0	0	0	0	0	0	0	0
TD901	99	1	0	0	0	0	0	0	0	0	0	0
M548E1**	98	2	0	0	0	0	0	0	0	0	0	0
ALL	98	2	0	0	0	0	0	0	0	0	0	0
VEHICLES WITH DEEP FORDING												
M151A2	98	2	0	0	0	0	0	0	0	0	0	0
M861	89	11	0	0	0	0	0	0	0	0	0	0
*M561	100	0	0	0	0	0	0	0	0	0	0	0
M35A2	100	0	0	0	0	0	0	0	0	0	0	0
M813	96	4	0	0	0	0	0	0	0	0	0	0
*M656	100	0	0	0	0	0	0	0	0	0	0	0
*M520E1	100	0	0	0	0	0	0	0	0	0	0	0
M125E1	98	2	0	0	0	0	0	0	0	0	0	0
M818/M125	96	4	0	0	0	0	0	0	0	0	0	0
TD901	99	1	0	0	0	0	0	0	0	0	0	0
M548E1**	98	2	0	0	0	0	0	0	0	0	0	0
ALL	98	2	0	0	0	0	0	0	0	0	0	0
VEHICLES FOR REFERENCE												
*M113A2	99	1	0	0	0	0	0	0	0	0	0	0
*XM723	100	0	0	0	0	0	0	0	0	0	0	0
*M551	99	1	0	0	0	0	0	0	0	0	0	0
M60A1	99	1	0	0	0	0	0	0	0	0	0	0
ALL	99	1	0	0	0	0	0	0	0	0	0	0

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**DEEP FORDING AS-IS

TABLE F5

RELATIVE LEVEL OF ASSISTANCE LEVELS REQUIRED
WACROSS MID-EAST AREA SOUTH-NORTH AXES

CORRIDOR WIDTH: 4.0 KM   AXIS LENGTH: 348.6 KM
FLOW STAGE: HIGH

	PERCENT											
ASSIST REQD	NONE (GO)	D7 EGRS	FILL FORD	UET EGRS	RIBB S-R	MAB S-R	BAIL BRDG	RIBB H/R	MGB	MAB H/R	AVLB	NUGO
					VEHICLES AS-IS							
M151A2	100	0	0	0	0	0	0	0	0	0	0	0
M861	93	7	0	0	0	0	0	0	0	0	0	0
*M561	100	0	0	0	0	0	0	0	0	0	0	0
M35A2	100	0	0	0	0	0	0	0	0	0	0	0
M813	97	3	0	0	0	0	0	0	0	0	0	0
*M656	100	0	0	0	0	0	0	0	0	0	0	0
*M520E1	100	0	0	0	0	0	0	0	0	0	0	0
M125E1	100	0	0	0	0	0	0	0	0	0	0	0
M818/M125	97	3	0	0	0	0	0	0	0	0	0	0
TD901	100	0	0	0	0	0	0	0	0	0	0	0
M548E1**	100	0	0	0	0	0	0	0	0	0	0	0
ALL	99	1	0	0	0	0	0	0	0	0	0	0
					VEHICLES WITH DEEP FORDING							
M151A2	100	0	0	0	0	0	0	0	0	0	0	0
M861	93	7	0	0	0	0	0	0	0	0	0	0
*M561	100	0	0	0	0	0	0	0	0	0	0	0
M35A2	100	0	0	0	0	0	0	0	0	0	0	0
M813	97	3	0	0	0	0	0	0	0	0	0	0
*M656	100	0	0	0	0	0	0	0	0	0	0	0
*M520E1	100	0	0	0	0	0	0	0	0	0	0	0
M125E1	100	0	0	0	0	0	0	0	0	0	0	0
M818/M125	97	3	0	0	0	0	0	0	0	0	0	0
TD901	100	0	0	0	0	0	0	0	0	0	0	0
M548E1**	100	0	0	0	0	0	0	0	0	0	0	0
ALL	99	1	0	0	0	0	0	0	0	0	0	0
					VEHICLES FOR REFERENCE							
*M113A2	100	0	0	0	0	0	0	0	0	0	0	0
*XM723	100	0	0	0	0	0	0	0	0	0	0	0
*M551	100	0	0	0	0	0	0	0	0	0	0	0
M60A1	100	0	0	0	0	0	0	0	0	0	0	0
ALL	100	0	0	0	0	0	0	0	0	0	0	0

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**DEEP FORDING AS-IS

TABLE F6

RELATIVE LEVEL OF ASSISTANCE LEVELS REQUIRED
WACROSS MID-EAST AREA SOUTH-NORTH AXES

CORRIDOR WIDTH: 4.0 KM AXIS LENGTH: 348.6 KM
FLOW STAGE: LOW

ASSIST REQD	PERCENT NONE (GO)	D7 EGRS	FILL FORD	DET EGRS	RIBB S-R	MAB S-R	BAIL BRDG	RIBB B/R	MGB	MAB B/R	AVLB	NOGO
VEHICLES AS-IS												
M151A2	100	0	0	0	0	0	0	0	0	0	0	0
M861	97	3	0	0	0	0	0	0	0	0	0	0
*M561	100	0	0	0	0	0	0	0	0	0	0	0
M35A2	100	0	0	0	0	0	0	0	0	0	0	0
M813	97	3	0	0	0	0	0	0	0	0	0	0
*M656	100	0	0	0	0	0	0	0	0	0	0	0
*M520E1	100	0	0	0	0	0	0	0	0	0	0	0
M125E1	100	0	0	0	0	0	0	0	0	0	0	0
M818/M125	97	3	0	0	0	0	0	0	0	0	0	0
TD901	100	0	0	0	0	0	0	0	0	0	0	0
M548E1**	100	0	0	0	0	0	0	0	0	0	0	0
ALL	99	1	0	0	0	0	0	0	0	0	0	0
VEHICLES WITH DEEP FORDING												
M151A2	100	0	0	0	0	0	0	0	0	0	0	0
M861	97	3	0	0	0	0	0	0	0	0	0	0
*M561	100	0	0	0	0	0	0	0	0	0	0	0
M35A2	100	0	0	0	0	0	0	0	0	0	0	0
M813	97	3	0	0	0	0	0	0	0	0	0	0
*M656	100	0	0	0	0	0	0	0	0	0	0	0
*M520E1	100	0	0	0	0	0	0	0	0	0	0	0
M125E1	100	0	0	0	0	0	0	0	0	0	0	0
M818/M125	97	3	0	0	0	0	0	0	0	0	0	0
TD901	100	0	0	0	0	0	0	0	0	0	0	0
M548E1**	100	0	0	0	0	0	0	0	0	0	0	0
ALL	99	1	0	0	0	0	0	0	0	0	0	0
VEHICLES FOR REFERENCE												
*M113A2	100	0	0	0	0	0	0	0	0	0	0	0
*XM723	100	0	0	0	0	0	0	0	0	0	0	0
*M551	100	0	0	0	0	0	0	0	0	0	0	0
M60A1	100	0	0	0	0	0	0	0	0	0	0	0
ALL	100	0	0	0	0	0	0	0	0	0	0	0

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In accordance with letter from DAEN-RDC, DAEN-ASI dated 22 July 1977, Subject: Facsimile Catalog Cards for Laboratory Technical Publications, a facsimile catalog card in Library of Congress MARC format is reproduced below.

Nuttall, Clifford J

An assessment of the inland water crossing performance of selected tactical support vehicles (WACROSS) / by C. J. Nuttall, Jr. Vicksburg, Miss. : U. S. Waterways Experiment Station ; Springfield, Va. : available from National Technical Information Service, 1979.

38, [99] p. : ill. ; 27 cm. (Technical report - U. S. Army Engineer Waterways Experiment Station ; GL-79-1)

Prepared for U. S. Army Transportation School, U. S. Army Training and Doctrine Command, Fort Eustis, Virginia.

References: p.37-38.

1. Gap crossings. 2. Mathematical models. 3. Military vehicles. 4. Stream crossings. 5. Tactical gaps. 6. Terrain data. 7. Vehicle performance. I. United States. Army Transportation School, Fort Eustis, Va. II. Series: United States. Waterways Experiment Station, Vicksburg, Miss. Technical report ; GL-79-1.

TA7.W34 no.GL-79-1